INDIAN RIVER CORRIDOR AND WATERSHED MASTER PLAN

CITY AND BOROUGH OF SITKA, ALASKA

Final Master Plan
October 2004

SUMMIT
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CITY AND BOROUGH OF SITKA
DECEMBER 2, 1971

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CITY AND BOROUGH OF SITKA

RESOLUTION NO. 2004-30

A RESOLUTION OF THE ASSEMBLY OF THE CITY AND BOROUGH OF SITKA, ALASKA SUPPORTING THE INDIAN RIVER CORRIDOR AND WATERSHED MASTER PLAN

WHEREAS, a portion of the Coastal Impact Assistance Program grant was used to permit the City and Borough of Sitka to develop a master development plan for Indian River corridor and watershed, and

WHEREAS, the mission of the Master Plan was to inventory the resources, existing conditions and potential development within the Primary Study Area of the Indian River Watershed and develop a plan that protects the watershed resources while encouraging responsible residential, commercial, industrial, cultural and recreational development; and

WHEREAS, the Master Plan is intended to promote community understanding of the assets and issues in the watershed and will be used as a guideline for future conservation, recreation, and municipal development; and

WHEREAS, Indian River and its riparian zone may be included as a designated site in the Sitka Coastal Program's current revision to permit the Sitka Plan's anadromous stream setback policy to be maintained in this important river corridor;

NOW, THEREFORE, BE IT RESOLVED by the Assembly of the City and Borough of Sitka, Alaska that Sitka endorses the Indian River Corridor and Watershed Master Plan to guide development and maintain the water quality of the Indian River Corridor and Watershed.

PASSED AND APPROVED by the Assembly of the City and Borough of Sitka, Alaska on this 12th day of October, 2004.

Fred Reeder, Mayor

ATTEST:

Colleen Pellett, CMC
Municipal Clerk

INDIAN RIVER CORRIDOR AND WATERSHED MASTER PLAN

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October, 2004

Funding for the Indian River Corridor and Watershed Master Plan was provided by a Coastal Impact Assistance Program grant administered by the Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, U.S. Department of Commerce

Executive Summary

The City and Borough of Sitka developed the Indian River Corridor and Watershed Master Plan as a tool for encouraging and managing responsible development within the Indian River watershed. The Master Plan document is a guide and resource for project planning, development and watershed management that protects watershed assets that were identified as important to the Sitka community.

The first phase of the Master Plan developed a comprehensive inventory of watershed assets. Because of the limited budget resources for the project, the watershed was divided into Primary and Secondary areas for study and inventory purposes. The Primary study area south of the Tongass National Forest boundary and north of Sawmill Creek Road was considered the area most likely to see development that could potentially have an adverse impact to the watershed. The majority of the project resources were devoted to the inventory in this area, and the inventory was limited to those items that were most likely to affect or be impacted by changes in water quality and fish habitat. Separate chapters of the Master Plan, including figures, charts, tables and maps were devoted to each of the following topics:

- **Property Ownership**
  A comprehensive list and maps of all of the major property owners within the watershed.
- **Hydrology and Water Resources**
  Includes descriptions of the watershed hydrology, water protection devices and structures in place, water resources including municipal, fish hatchery and hydropower, and a discussion and summary of water rights. Includes hydrological maps, tables and figures.
- **Recreational Trails and Historical Areas**
  Describes the current trail systems and recreational facilities, and provides information on historical and cultural backgrounds and issues in the watershed. Includes a map of the current trail system.
- **Wetlands**
  Provides an overview of different types of wetlands to be found in the watershed and describes some of the permitting requirements for developing wetlands. Includes a map of the probable wetland areas.
- **Utility Infrastructure**
  Summarizes the various types of utility infrastructure that are currently in place including water, sewer, electric, storm drains and roads, and includes maps of the utility infrastructure.
- **Solid Waste**
  Provides an overview of solid waste issues and concerns in the watershed and shows the solid waste features on a map.

- **Existing Permits and Planning Documents**
  Includes a discussion and summary of current permits that have been issued for projects within the watershed and a summary of relevant planning documents that could impact project planning and development.
- **Proposed and Potential Development**
  Provides an overview of projects that are in various stages of planning and development within the watershed and shows the projects on maps. Includes an analysis of projected land development area requirements.
- **Fish Habitat and River Environment**
  Presents and summarizes the fish habitat and river environment field studies that were preformed to support the Master Plan, analyzes potential development impact, and provides recommendations to maintain water quality and fish habitat in the riparian areas of the watershed. Includes a series of maps showing fish habitat and river environment conditions.

At the conclusion of the Inventory tasks, a list of potential improvement projects was developed. Chapter 11 describes potential watershed improvements for the current level of development that will protect and enhance water quality and fish habitat and provides a scope of work and cost estimates for these projects.

Finally, Chapter 12 includes a discussion of watershed protection best management practices, current management tools, and recommendations for future management guidelines.

Mission Statement

Our mission is to inventory the resources, existing conditions and potential development within the Primary Study Area of the Indian River Watershed and to develop a plan that protects the watershed resources while encouraging responsible residential, commercial, industrial, cultural and recreational development that is consistent with community needs and governmental regulations. The Master Plan is intended to promote community understanding of the assets and issues in the watershed and will be used as a guideline for future conservation, recreation and municipal development.

Table of Contents

Introduction

The Indian River Watershed in Sitka is currently used as a scenic, educational, historical, cultural, recreational, industrial, water supply and bird and fish habitat resource. Existing development includes Sheldon Jackson College, the Alaska Raptor Center, the Public Safety Academy, residential subdivisions, a rock quarry, a backup municipal water supply, the Sitka National Historical Park, recreational hiking trails, cemeteries and other facilities. Sitka is also a growing community, and the City and Borough of Sitka recognized the potential for additional development within the watershed, and also acknowledged the need to conserve and protect the existing resources that help define the community. The Indian River Corridor and Watershed Master Plan project grew out of the awareness that a proactive role was needed to ensure that future development in the watershed was consistent with the Sitka community's needs and interests.

The City and Borough of Sitka has asked *Summit Consulting Services*, and their sub consultants Dr. Liz Flory, PhD. of *Aquatic Sciences, Inc*. and Mark Storm, P.E. of *Keta Engineering* to produce a Master Plan document that accurately describes the current conditions in the watershed, identifies critical and valuable community assets, and provides guidelines for development that protect and enhance the resources of the Indian River Watershed. Dr. Flory researched and developed information of fish habitat and river environment and Mr. Storm assisted with the hydrological and hydraulic evaluation of the watershed study area.

Master plans are guidelines for development of a resource that is valued by the community. The Master Plan will be used to guide future development of the Indian River Watershed in accordance with needs and desires of the local community and within the limitations imposed by available funding, local, state and federal government regulations and development requirements. There are diverse needs, values and viewpoints within the Sitka community; a good master plan takes all these considerations into account when planning resource development. Sitka residents value the scenic, cultural and recreational aspects of the Indian River, yet also recognize that it is vital to the economic health of the area to permit and encourage the responsible development of the land and resources. The Indian River Corridor and Watershed Master Plan will be a key tool in ensuring that necessary development is accomplished in an environmentally and culturally sensitive and acceptable manner.

In order to narrow the focus of the Master Plan and to accomplish as much as possible with the limited funding available for this project, the watershed was divided into two sections: The Primary Study Area, from Sawmill Creek Road north to the northern edge of Sheldon Jackson College property, and the Secondary Study Area, south of Sawmill Creek Road to the mouth of the river, including the Sheldon Jackson College campus and the Sitka National Historical park, and north of the SJC property line into the Tongass National Forest. The majority of the inventory and planning effort is focused on the Primary Study Area. The Secondary Study Area is included in general discussions of the watershed to the extent that they impact the watershed with development plans.

The Master Plan process was divided into a series of tasks, identified as follows:

Task 1 – Refine the Scope of Work
Summit Consulting Services met with the City and Borough of Sitka (CBS) in November of 2003. The Master Plan format and the scope of work were refined to meet the needs of the CBS staff and still permit the work to be completed within the available budget. A preliminary schedule was also determined.

Task 2 - Inventory
The Inventory task developed an inventory of the existing resources within the Primary Study Area. Chapters 1 through 10 of the Master Plan include inventories and discussion of the following items:

- Property ownership.
- Watershed hydrology and water resources, including drinking water, water rights and hydroelectric resources.
- Recreational trails and historical areas.
- Wetlands.
- Utility infrastructure including water, sewer, electric, storm drains and roads.
- Solid waste issues.
- Current development and environmental permits and conditions.
- Current and planned subdivisions and other proposed developments.
- Fish habitat and river environmental inventory.

In addition to developing an inventory of the Indian River Watershed, the consultant met with watershed landowners and agencies that have regulatory oversight responsibilities within the watershed. In order to make this task more efficient, the Indian River Working Group (IRWG) was formed. IRWG member met periodically with the consultant, both individually and in group meetings and provided information essential to the completion of the Master Plan. A list of the IRWG members is included in Appendix A of the master Plan. Appendix B includes a list of some of the source documents that were used as to provide background information for the Master Plan.

Task 3 - Community Meeting on Inventories
The findings of the Inventory Task 2 were presented in an open community meeting on March 17, 2004 in Sitka, and public comment and input into the Master Plan process was solicited. In order to further enhance the public notification and input process, an electronic PDF version of the draft Master Plan was developed and posted on the City and Borough of Sitka web site, www.cityofsitka.com. The draft Master Plan was periodically updated on the web site as comments were received.

Task 4 - Development of Potential Watershed Improvements for Existing Development and Management Guidelines for Future Development
Based on the findings of the Inventory Task and input from the IRWG and the general public, specific projects were identified that could help maintain the water quality and fish habitat within the existing developed areas of the watershed. Rough order-of-

magnitude cost estimates for these improvements were developed, and the information was presented in Chapter 11.

Chapter 12 of the Master Plan recommends management guidelines and strategies that will limit the impact of future proposed and potential development on water quality and fish habitat. The goals of the management guidelines are to prevent any degradation in water quality or fish habitat, and to maintain the current hydrological characteristics of the watershed, including peak runoff flows and sediment loads in the storm water.

Task 5 - Public Meeting on Potential Watershed Improvements and Future Development Management Guidelines

IRWG and public meetings were held to review the proposed watershed improvement and management guidelines strategies. Meetings were held in Sitka on September 15, and September 21, 2004.

Task 6 - Refinement of Potential Watershed Improvements and Future Development Management Guidelines

The watershed management strategies identified in the previous task were revised and refined based on public and IRWG comments. The final Master Plan was presented to the City and Borough of Sitka Assembly on October 21, 2004.

Task 7 - Publication of Summary Brochure and Final Master Plan

Thirty copies of the final Master Plan and 30 copies of a Master Plan summary were prepared and submitted to the City and Borough of Sitka. In addition, 3 unbound copies of the Master Plan with 11 x 17 color maps and digital copies of all Master Plan documents were also provided. The Final Master Plan was also posted to the cityofsitka.com website.

Chapter 1: Study Area

Indian River is located about one mile east of the center of Sitka on Baranof Island in Southeast Alaska, as shown in the general location and vicinity map on Figure 1, page 7. The Master Plan study divides the watershed into two separate areas: The Primary Study Area, bounded by Sawmill Creek Road on the south, the northern edge of the Sheldon Jackson College property on the north, and by the Indian River Watershed drainage boundaries on the east and west. The Secondary Study Areas are the watershed drainage to the south of Sawmill Creek Road, primarily the Sheldon Jackson College campus and the Sitka National Historical Park, and the Indian River Watershed to the north of the Sheldon Jackson property. The Primary and Secondary Study Area boundaries are shown on Figure 2, page 9. The Primary Study Area is approximately 1,300 acres, and the secondary study area is approximately 6,600 acres. The decision to divide the study into two areas was based on the likelihood that most development within the watershed will take place within the Primary Study Area, enabling the limited Master Plan budget to focus on developing an inventory of the watershed resources in areas most likely to be impacted by future development plans. The Secondary Study Areas, although important to the health of the watershed, are either already mostly developed (SJC or Sitka National Historical Park to the south) or will likely remain undeveloped (national forest and state land to the north).

Also shown on Figure 2 is the outline of the base map photo coverage. The City and Borough of Sitka is in the process of developing a Geographic Information System mapping project, and has recently completed detailed aerial mapping of the Sitka vicinity. The photo coverage, although not completely covering the entire Primary Study Area, is very high resolution, and provides a good visual background to help in developing the inventory and understanding of the watershed in the Primary Study Area.

Figure 3, page 11, is a larger scale map of the Primary Study Area, with the study area boundaries shown in red.

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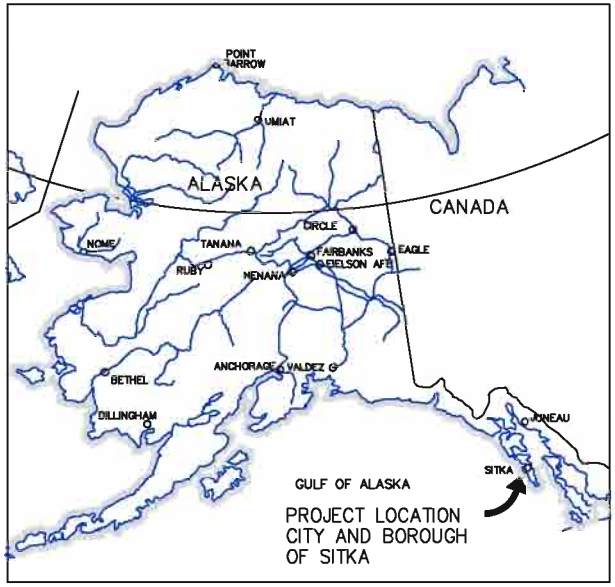
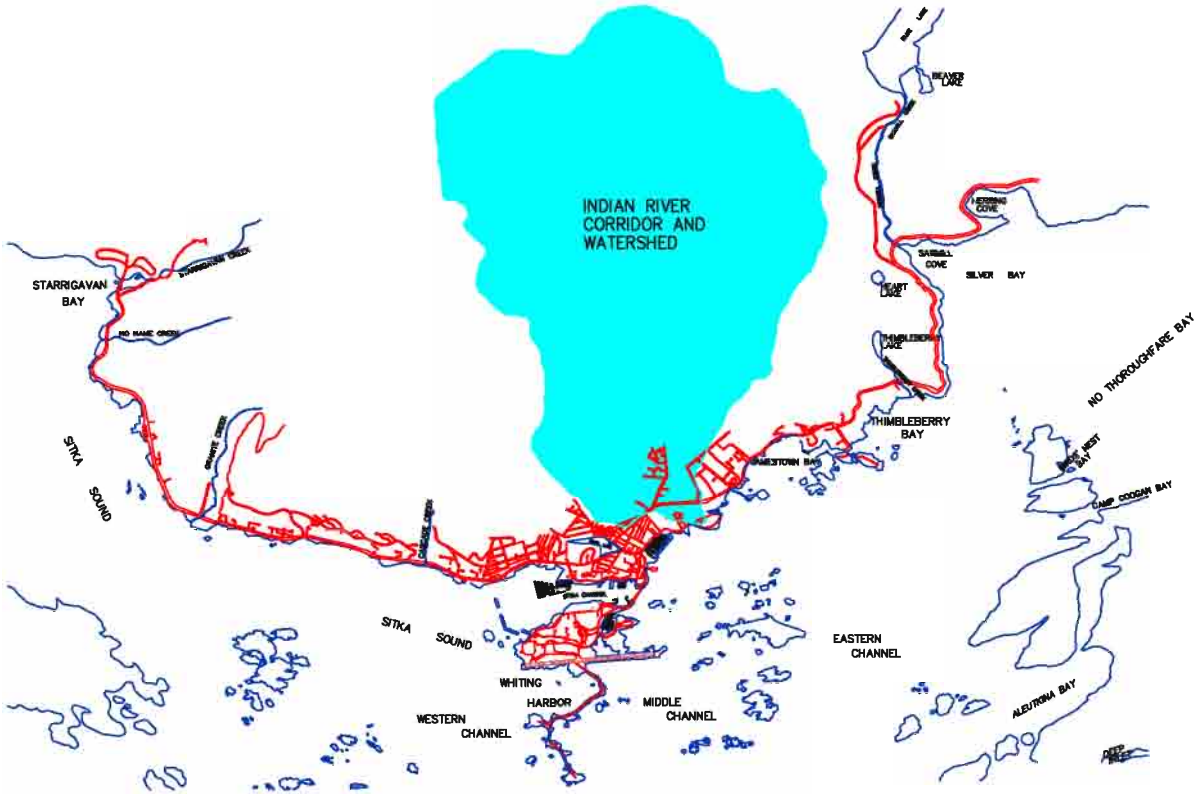
CITY AND BOROUGH OF SITKA, ALASKA

LOCATION AND VICINITY MAPS

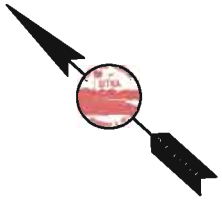
FIG 1



LOCATION MAP

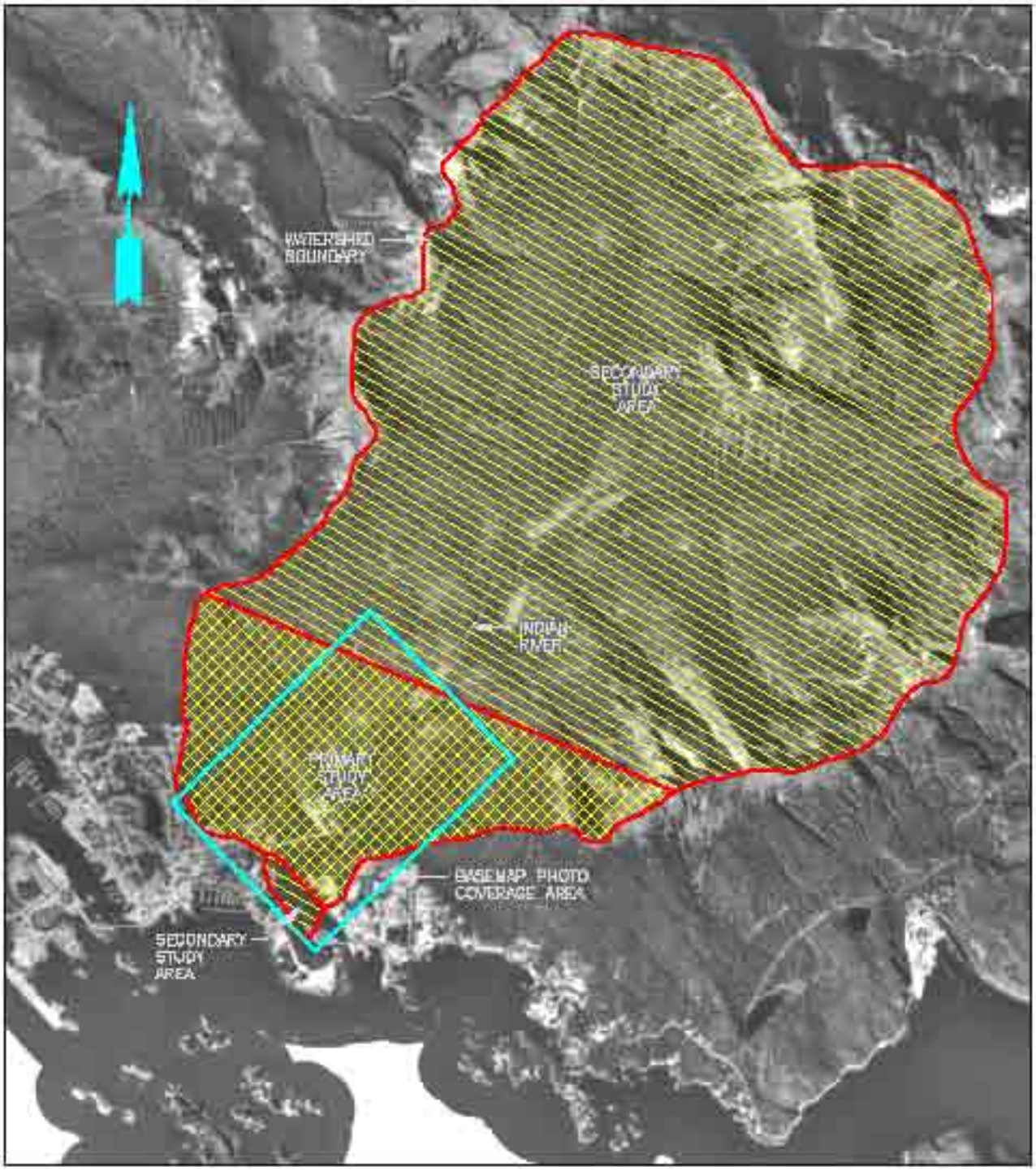


VICINITY MAP



INDIAN RIVER WATERSHED

APPROXIMATE SIZE: 7800 ACRES



PRIMARY STUDY AREA: 1300 ACRES — NORTH OF SAWMILL CREEK ROAD TO THE NORTHERN BOUNDARY OF SHELDON JACKSON PROPERTY

SECONDARY STUDY AREA: 5600 ACRES — NORTH OF THE SHELDON JACKSON PROPERTY LINE, SOUTH OF SAWMILL CREEK ROAD

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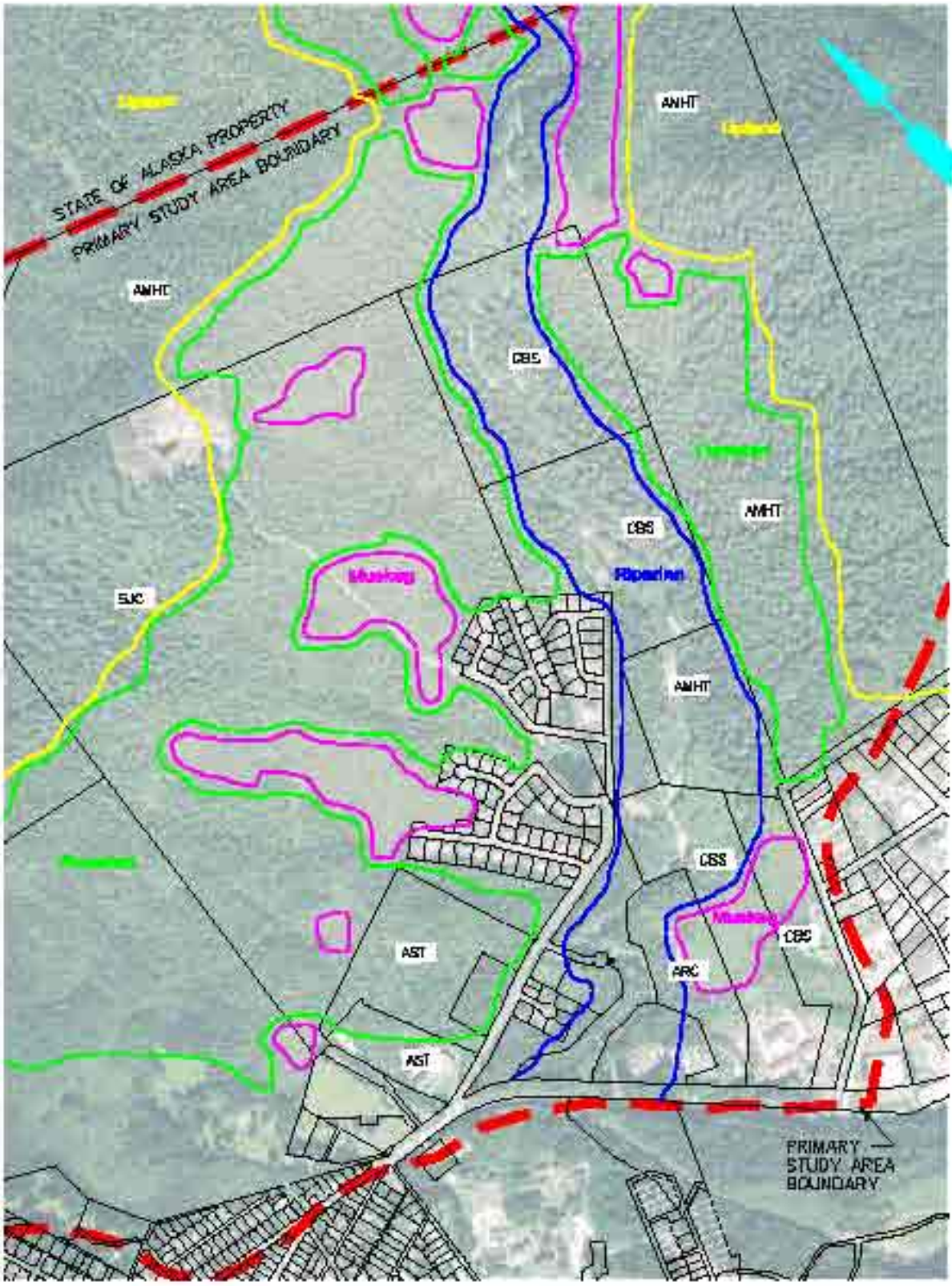
PRIMARY AND SECONDARY STUDY AREAS

FIG 2



WETLAND BOUNDARIES

- RIPARIAN
- FORESTED
- MUSKEG
- UPLAND (NON WETLAND)

NOTE: REF. CHAPTER 5 AND FIG. 8 FOR ADDITIONAL WETLANDS INFORMATION.

PRIMARY STUDY AREA: SAWMILL CREEK ROAD TO NATIONAL FOREST BOUNDARY, BOUNDED BY THE RIVER WATERSHED ON THE EAST & WEST

PHOTOGRAPHIC BACKGROUND: BASED ON 2003 AERIAL PHOTOGRAPHY BY DELTA AERIAL SURVEYS

MAJOR PROPERTY OWNERSHIP:
AMHT – ALASKA MENTAL HEALTH TRUST
ARC – ALASKA RAPTOR CENTER
AST – ALASKA STATE TROOPERS
CBS – CITY & BOROUGH OF SITKA
SJC – SHELDON JACKSON COLLEGE

FOR ADDITIONAL PROPERTY OWNERSHIP REFERENCE FIGURES 4A AND 4B

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PRIMARY STUDY AREA

FIG 3

Chapter 2: Property Ownership

Property ownership within the watershed is a mixture of public and private entities, with the largest proportion of land in public ownership. Two maps, Figures 4A and 4B, have been prepared with property ownership information shown.

State of Alaska
In Figure 4A, page 17, the extent of State of Alaska-owned land in the upper watershed area is shown. The total amount of this area is approximately 1,427 acres, and was nominated by CBS and selected by the State of Alaska from land within the Tongass National Forest to be managed as a municipal watershed and for community recreation. The state land in the Indian River Watershed is designated Pr, Ru. The specific State of Alaska land use designations are as follows (from the Northern Southeast Area Plan, Alaska Department of Natural Resources): The State of Alaska also owns the submerged riverbed beneath Indian River to the extent granted by the Alaska Statehood Act, which grants ownership of navigable river beds to the State.

Pr – Public Facilities – Retain
These sites are reserved for a specific infrastructure to serve state interests. These units are classified Reserved Use Land and are not selectable by municipalities under state law (except under AS 38.05.810). Units designated "Public Facilities – Retain" will be retained in state ownership, while units designated "Public Facilities – Transfer" may be converted to municipalities, but not sold to individuals.

Ru – Public Recreation and Tourism – Undeveloped.
This designation applies to those areas that offer high potential for dispersed recreation or tourism and where desirable recreation conditions are scattered or widespread rather than localized. Developed facilities are generally not necessary other than trails, trail signs, primitive campsites and other minor improvements. Land in this designation may be conveyed to municipalities depending on the unit's management intent and the relative value of the recreation resources for which the unit was designated. These lands cannot be sold to individuals. This designation can also apply to tidelands. If used as a tideland designation, it applies to areas that are widely used for recreation by either commercial operators or the public and is usually associated with the use of fisheries or the viewing of a unique or scenic area. Use patterns are dispersed over a fairly large area, and few public facilities are provided other than boat launches, docks, and mooring buoys. Tidelands can be conveyed to municipalities under certain conditions, but cannot be transferred to individuals.

The Northern Southeast Area Plan management intent for the Indian River area is as follows:

"Parcel is to be retained in state ownership and managed to protect and maintained its public recreation and watershed values. The type of public recreation is intended to be

that associated with the dispersed recreation designation of Undeveloped Recreation. The Parcel should also be managed as a watershed. Development authorizations should be limited to structures related to public recreations or a water supply system, although easements and rights-of-ways are considered appropriate.

"This very large, flat parcel is drained by the Indian River. It is characterized by western Hemlock and Sitka Spruce in the better drained areas and is moderately sloping terrain. The remainder of the parcel is palustrine wetlands, primarily of a shrub or forested type. There are some riverine wetlands adjoining the Indian River. The parcel contains a number of trails which provide access to the remainder of Indian Valley, but also connect to the city's trail system, situated to the north and west. The trail system is used extensively for hiking during the summer months. This parcel also functions as part of the watershed for the community water system, providing the primary supply for the Sitka National Historic Park and the Sheldon Jackson University hatchery and functioning as the city's back up supply system. This parcel was selected for the purpose of watershed protection and community recreation."

Federal Lands

The remaining land in the upper watershed is part of the Tongass National Forest, and is managed by the U.S. Forest Service. National Forest Lands within the secondary study area and the 104-acre parcel within the Primary Study Area are designated as *Municipal Watershed* in the 1997 Tongass National Forest Land and Resource Management Plan. The emphasis of this Land Use designation is to provide protection of the municipal water supplies for the incorporated City and Borough of Sitka. U.S. Forest Service management prescriptions for lands designated as Municipal Watershed are:

Goals:

To maintain these watersheds as municipal water supply reserves, in a manner that meets State of Alaska Drinking Water Regulations and Water Quality Standards for water supply.

Objectives:

Limit most management activities to the protection and maintenance of natural resources. Fish habitat enhancements, and watershed and wildlife habitat improvements, may occur if they are compatible with the municipality's watershed management objectives.

Classify forested land as unsuitable for timber production. Salvage logging will only occur after consultation with the municipality.

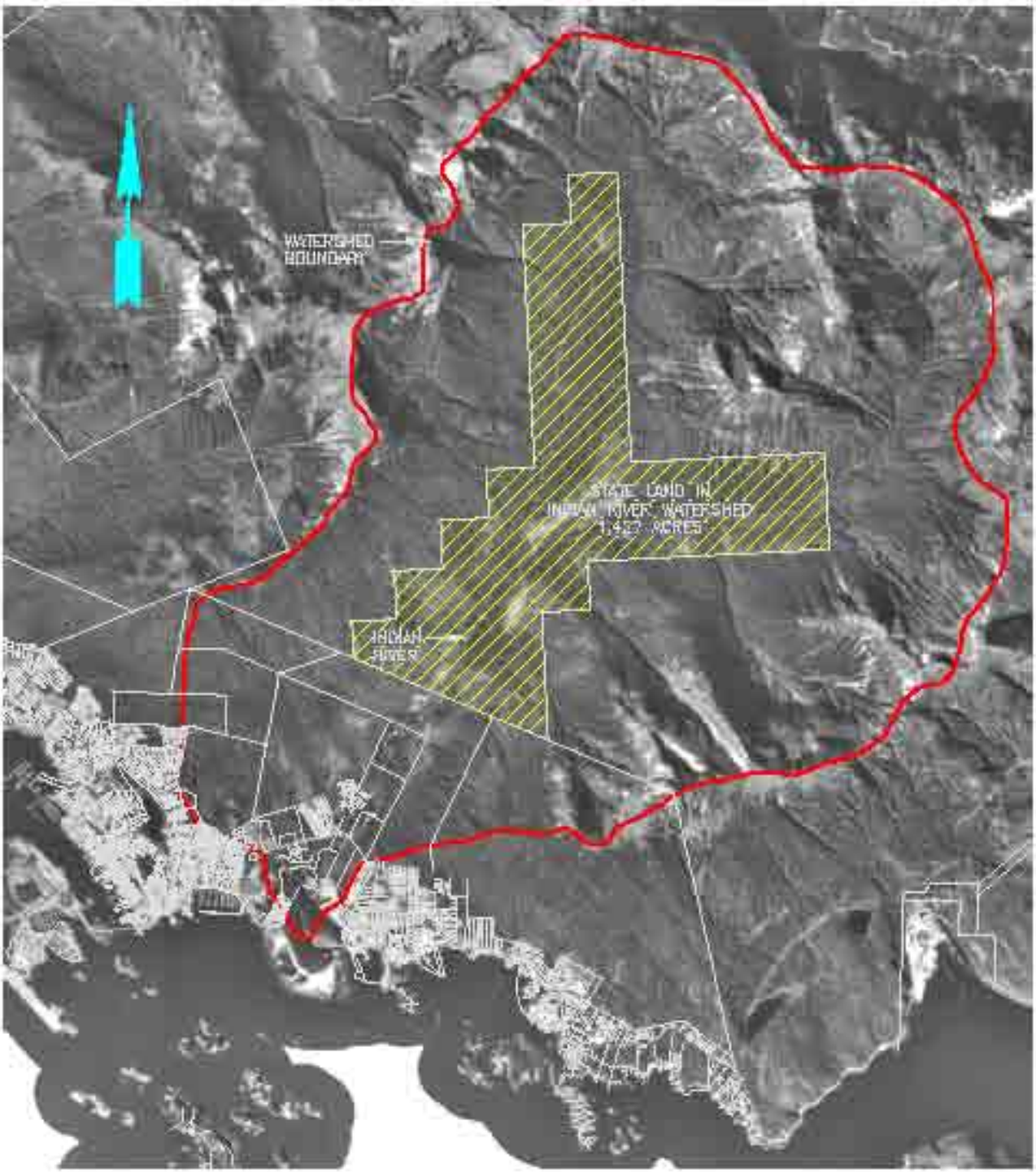
Recreation uses will be authorized by the Forest Service officer with delegated authority, in consultation with the municipality and will be limited to those that will protect water quality and flow.

Desired Condition:
Lands managed as Municipal Watersheds are generally in a natural condition. Facilities or structures to provide municipal water supplies may be present. Uses or activities that could adversely affect water quality or supply do not occur. These watersheds provide municipal water that meets all State Drinking Water Regulations and Water Quality Standards for water supply.

In Figure 4B, page 19, land in the Primary study is shown. The landowners are identified and the approximate size of their holdings is shown. The property ownership maps are based on information obtained from the CBS Planning Department, and the boundaries and lot sizes area approximate. Prior to any development work, a land survey is recommended for each specific project.

Primary Study Area Landowners
The major landowners and facilities are:

- State of Alaska Mental Health Trust (AMHT)
- U.S. Forest Service (USFS)
- State of Alaska Department of Public Safety (DPS)
    - Public Safety Academy
- City and Borough of Sitka (CBS)
    - Municipal Animal Shelter
    - Public Works Garage and Electric Substation
    - Solid Waste Transfer Station
- National Park Service (NPS)
    - Sitka National Historical Park
- US Coast and Geodetic Survey (USCG)
    - Geomagnetic Station
- Sheldon Jackson College (SJC)
    - Flume to Fish Hatchery
- Baranof Island Housing Authority (BIHA)
    - Kaasda Heen Shaak, Kadak w. Adi, Ashaak
- Alaska Raptor Center
- Sitka Counseling and Prevention Services (SC&PS) (leased from SJC and CBS)
    - Treatment Center
- Mick Tisher Construction Quarry (leased from SJC)
- Private landowners, Pamco Subdivision
- There are also a number of public cemeteries within the watershed.



NOTE: PROPERTY LINE LOCATIONS ARE APPROXIMATE, AND ARE BASED ON CITY OF SITKA PROPERTY BASEMAPS. REFER TO FIGURE 4B FOR ADDITIONAL INFORMATION ON PROPERTY OWNERSHIP IN PRIMARY STUDY AREA.

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STATE SELECTED LAND IN TONGASS NATIONAL FOREST

FIG 4A

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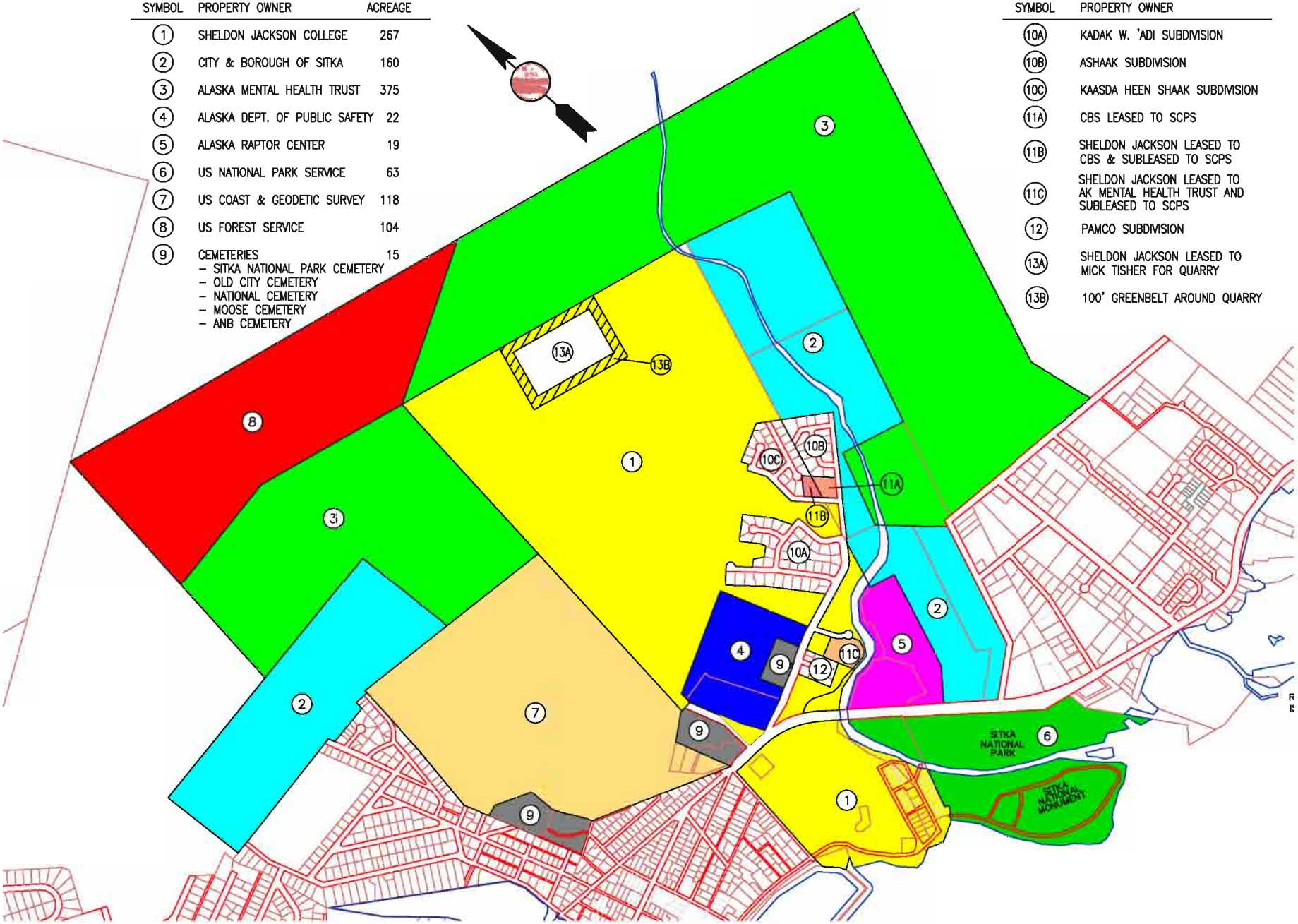
PRIMARY STUDY AREA PROPERTY OWNERSHIP

FIG 4B

SYMBOL	PROPERTY OWNER	ACREAGE
1	SHELDON JACKSON COLLEGE	267
2	CITY & BOROUGH OF SITKA	160
3	ALASKA MENTAL HEALTH TRUST	375
4	ALASKA DEPT. OF PUBLIC SAFETY	22
5	ALASKA RAPTOR CENTER	19
6	US NATIONAL PARK SERVICE	63
7	US COAST & GEODETIC SURVEY	118
8	US FOREST SERVICE	104
9	CEMETERIES – SITKA NATIONAL PARK CEMETERY – OLD CITY CEMETERY – NATIONAL CEMETERY – MOOSE CEMETERY – ANB CEMETERY	15

SYMBOL	PROPERTY OWNER
10A	KADAK W. 'ADI SUBDIVISION
10B	ASHAAK SUBDIVISION
10C	KAASDA HEEN SHAAK SUBDIVISION
11A	CBS LEASED TO SCPS
11B	SHELDON JACKSON LEASED TO CBS & SUBLEASED TO SCPS
11C	SHELDON JACKSON LEASED TO AK MENTAL HEALTH TRUST AND SUBLEASED TO SCPS
12	PAMCO SUBDIVISION
13A	SHELDON JACKSON LEASED TO MICK TISHER FOR QUARRY
13B	100' GREENBELT AROUND QUARRY



Chapter 3: Hydrology and Water Resources

The hydrology and water resources section is divided into separate subsections: Hydrology; Water Resources; Water Rights; and Hydropower. Each section is preceded by an overall summary of the issues, and is followed by a more technical analysis and supporting documentation.

Hydrology Summary
Sitka and the Indian River Watershed are located on the outer coast of Southeast Alaska's Alexander Archipelago. Weather is influenced by the temperate maritime climate with frequent precipitation in all months throughout the year. Annual precipitation is approximately 90 inches in Sitka. Fall months are the wettest and late spring months are the driest. Precipitation in the watershed is higher than in town due to the orographic effects produced by the mountains. Figure 5, page 23, illustrates the hydrological features of the study area.

Fall months generally have the highest streamflows. These events are usually the result of large sustained precipitation events in the basin. Streamflow in Indian River closely corresponds to precipitation events. The basin's lack of lakes, high drainage density (miles of stream per acre of watershed), generally shallow soils, steep upper slopes and relatively small size make streamflow peaks mirror precipitation peaks with only a short lag in time between the two.

Muskeg wetlands are present in much of the watershed, particularly in the relatively level benches above the valley floor. These muskeg wetlands general locations are illustrated on Figure 5, page 23. The muskegs help to attenuate streamflows by detaining precipitation and releasing it as runoff more gradually over time than if the precipitation had fallen on other surfaces that make up the watershed. This process dampens runoff peaks from tributary streams draining the muskeg areas thereby reducing peak flows in Indian River. Similarly, baseflows are augmented by the gradual releases of water that is stored in the muskegs. These releases help to bolster low flow levels in Indian River when runoff from other areas is minimal or nonexistent. This function of runoff attenuation that the muskeg areas produce is valuable to reduce flood peaks (and therefore flood damage) and also to maintain flows to provide habitat and a source of water for consumptive uses during extended dry and/or sub-freezing conditions.

Stream discharge and water quality measurements have been made by the U.S. Geological Survey (USGS) at several stations over a period of years. Water quality measurements made by the USGS for SNHP reveal that water quality is good for all parameters examined. Water quality in Indian River has shown little variation between pristine upstream locations and reaches downstream of existing development where development-related impacts might be expected to be present. USGS Gage 15087690 is located a short distance upstream of the end of Indian River Road and has the longest period of record (POR) of all gages on the system. This station was operated between

1980 and 1993. The gage was re-established in 1998 and is presently being operated and maintained by USGS. Data was available through water year 2001 for an available POR of 17 years. Respective streamflow and precipitation data from this gage and the weather station located at the airport are summarized in the hydrology technical memorandum following Figure 5, page 23.

Low flows can occur in any month in Indian River, but are most severe in late winter and in summer months. Fall months have higher flows due to the frequent storms from the Gulf of Alaska that bring precipitation to the watershed. Streamflow in the spring months is supplemented by snowmelt and low flows during these months tend not to be as severe due to this additional input.

Annual peak flows are most likely to occur in the late summer, fall and winter months when heaviest precipitation occurs. No annual peak flow events have occurred in spring and summer months (March through July) during the periods of recorded streamflow in Indian River.

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HYDROLOGY

FIG 3

Water Resources Summary

Water resources in the Indian River Basin are comprised of both natural and man-made features. Natural features include the river channel and floodplain corridor which provide recreational areas, habitat for fish and wildlife and provision and protection of water for consumptive use. Water resources features in the project area are illustrated in Figure 6A, page 27.

Muskeg wetlands provide a resource in the basin for attenuating river flows and for promoting sedimentation and filtration to naturally treat stormwater runoff. Muskegs are illustrated on Figure 5, page 23. These areas represent probable wetlands areas as determined through aerial photo interpretation and the limited field investigations conducted. The areas illustrated in Figure 5, page 23 are intended for planning purposes and are not intended as a formal wetland delineation such as may be required for permitting purposes. A detailed and site specific wetlands delineation and mapping effort is beyond the scope of this project due to budget constraints.

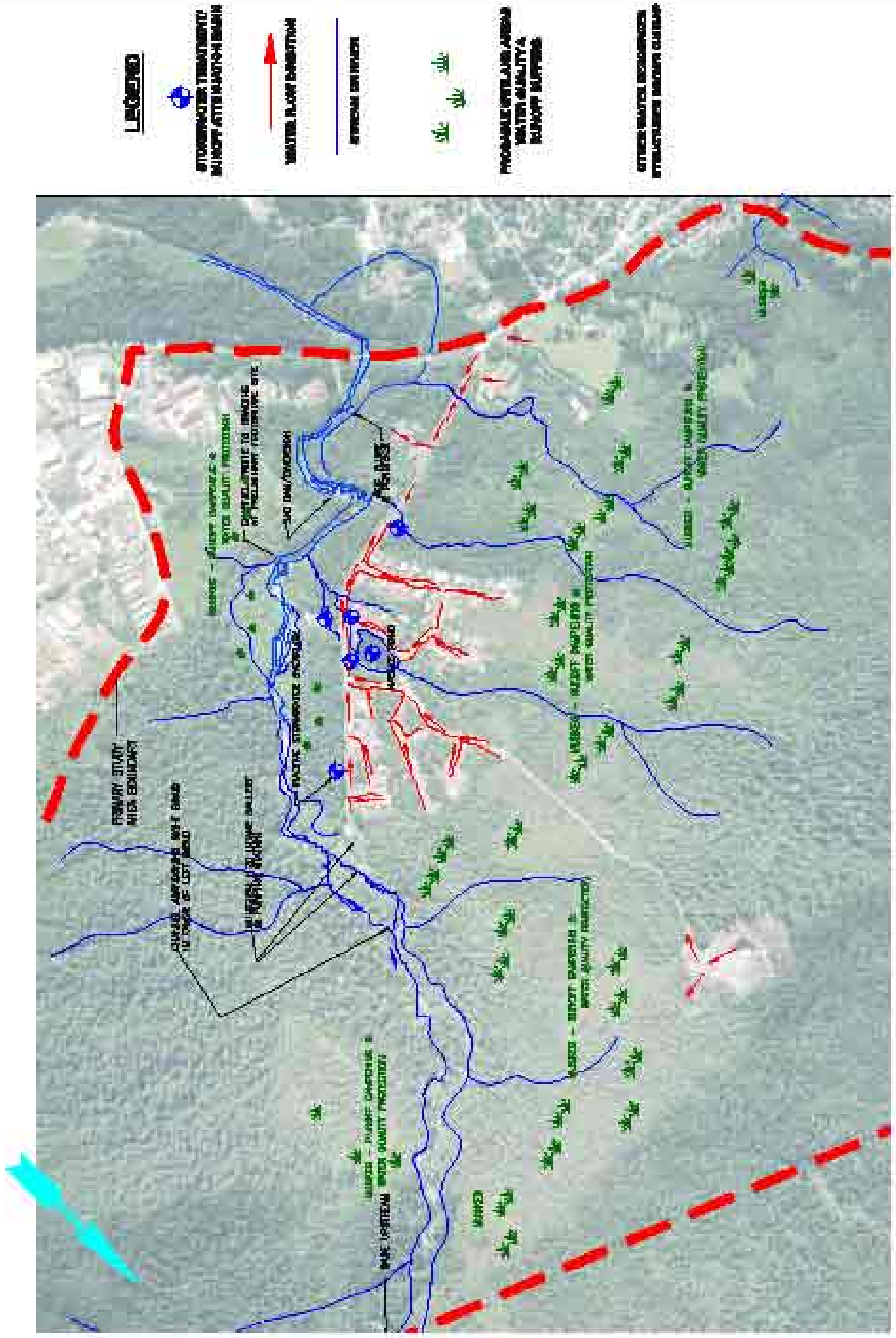
Several hydraulic structures exist in the Indian River Watershed. CBS owns and operates a run-of-the-river diversion facility at approximately river mile 1.4. This facility was the City's primary source of water but is now operated only as a backup source since CBS developed the Blue Lake project. The existing diversion facility on Indian River is in jeopardy of failing if the river changes its course. The river channel braids upstream of the diversion and threatens to abandon its right braid (which feeds the CBS intake) in favor of the left braid. The dam exacerbates depositional and erosional processes that are causing the channel to change course. Figure 6B, page 37 illustrates these processes that are currently underway in the reach of Indian River where the CBS water intake is located. The Indian River water intake in its current condition most likely will not be able to meet CBS water demand without significant renovations.

Stormwater detention and treatment facilities exist in the Indian River Watershed in the BIHA subdivision areas. These facilities consist of a detention pond with smaller basins that are connected and provide additional detention for large runoff events. These basins provide primary treatment of stormwater runoff by promoting sedimentation of particulates. Grass-lined ditches and swales also exist in this area and provide treatment, detention and retention of stormwater via bio-filtration, controlled release and infiltration respectively. Stormwater detention and treatment areas are shown on Figure 6B, page 37.

SJC owns and operates a dam on lower Indian River. This facility supplies water to the SJC hatchery and, until 1988, also powered a small hydroelectric turbine on the SJC campus. This facility does not have any significant storage volume and therefore provides no flood attenuation. The facility does promote deposition of bed material in its pool. This sediment is not able to migrate downstream of the dam. This may be increasing channel scour in reaches downstream of the dam.

Two existing bridges cross Indian River within the Primary Study Area. The Sawmill Creek Road Bridge and an adjacent pedestrian bridge cross Indian River just upstream of SNHP. Scour has occurred at the right-bank foundation of the pedestrian bridge causing

its failure. Some scour was also evident at the Sawmill Creek Road Bridge although this structure appeared to be in no imminent danger. A pedestrian bridge is planned to cross Indian River in the vicinity of an existing ruins of an abandoned log bridge near the BIHA subdivision. This site is shown on Figure 6A, page 27. The river at the site of the existing bridge ruins is braided and has low stream banks that provide good connectivity to the floodplain. Alternative sites where the river is better to suited to bridge crossing should be considered in lieu of the site of the log bridge ruins.



SUMMIT CONSULTING SERVICES Inc.

INDIAN RIVER CORRIDOR AND WATERSHED MASTER PLAN

CITY AND BOROUGH OF SITKA, ALASKA

WATER PROTECTION STRUCTURES

FIG 6A

Hydrology and Water Resources Technical Memorandum
This memo presents the findings of a field investigation and document review for Task 2A of the Indian River Watershed Master Plan. The investigation and research was intended to observe and characterize watershed's existing hydrological conditions within a planning context to assess impacts and results of past development and to identify water resources that are the most like to be affected by proposed development.

The Indian River basin was visited on November 18-20, 2003. During this period the basin was walked and conditions observed to characterize the basin. City and agency personnel were consulted to obtain data, reports, maps as well as to obtain anecdotal evidence of the of the Indian River Watershed's characteristics.

The weather was clear and dry in Sitka during the period when field investigation took place. Consequentially, surface runoff was not present in much of the basin. This made evaluation of storm drainage systems in existing developments difficult as no runoff was present. However, dry weather made good conditions for observing drainage having groundwater sources, e.g. muskeg sources, and for exposing much of the riverbed in the baseflow conditions that were present in streams of the Indian River Watershed at that time.

Watershed Climate and Hydrology
Sitka is located on the outer coast of Southeast Alaska's Alexander Archipelago. Weather is influenced by the maritime climate and precipitation is high throughout the year. Annual precipitation is approximately 89 inches at the NOAA NWS weather station (NWS Station cooperative ID 508494) located at the airport on Japonski Island near the Indian River Watershed. Precipitation varies greatly with locale in Southeast Alaska and precipitation is no doubt greater in the upper Indian River Watershed than it is at the airport weather station. Precipitation in the Sitka area is highest in the fall and winter. Winter precipitation falls as both rain and snow with snow predominating at higher elevations. Hydrological features in the study area are illustrated on Figure 5, page 23.

Stream discharge and water quality measurements have been made by USGS at several stations over a period of years. USGS Gage 15087690 has the longest period of record (POR) of these gages. This station was operated between 1980 and 1993. The gage was re-established in 1998 and is presently being operated and maintained by USGS. Data was available through 2001 for an available POR of 17 years. Average, minimum and maximum monthly streamflows in Indian River are illustrated in Chart 1, page 40.

Table 1, page 30 shows average monthly precipitation for the NOAA NWS weather station at Japonski airport and the corresponding average monthly streamflow at USGS Gage 15087690 expressed as inches of runoff from the watershed. The ratio of Indian River streamflow to airport precipitation is always greater than one. This reveals precipitation in the watershed is greater than at the airport weather station. The monthly streamflow/precipitation ratio's change from the annual ratio reveals basin water budget characteristics. Negative changes are seen in winter months and are indicative of water

being stored as snow in the basin. Highly positive changes, e.g. May and June, reveal snowmelt augmenting stream runoff.

Table 1: Average Monthly Precipitation, Stream Discharge and Ratios

Month	Precipitation (in) NWS Station 508494	Streamflow (in) USGS Gage 15087690	Ratio of Streamflow to Precipitation	Change of Ratio from Annual Average
January	7.40	11.5	1.55	-3.7%
February	6.19	8.4	1.36	-15%
March	5.95	7.3	1.23	-24%
April	4.76	7.7	1.62	+0.6%
May	4.63	12.3	2.66	+65%
June	3.44	10	2.91	+81%
July	4.27	7.3	1.71	+6.2%
August	6.76	9.8	1.45	-9.9%
September	11.11	19.2	1.73	+7.5%
October	13.43	21.7	1.62	+0.6%
November	9.62	11.4	1.19	-26%
December	8.65	11.8	1.36	-16%
	86.21	138.6	1.61	0%

Streamflow in Indian River is generally highest in the fall months of October and November. Peak flow events generally coincide closely with storm events. The Indian River Basin has no major lakes and relatively small amounts of depression storage areas for precipitation to be detained. Flood peaks usually occur within 24 hours of the peaks of precipitation events (Paustian 1998). Most annual peak flow events occur in the fall months. Table 2, page 32, shows the magnitude of peak flow events measured by the Indian River gage, their ranking and their month of occurrence. Table 3, page 32, shows the number of annual peak flow events for each month of the year. All peak flow events occurred in the fall and winter months reflecting the effects of heavy precipitation events that occur during the season. Annual peak flow events occurred in the fall months of August, September or October in 11 out of the 17 years of POR (65%).

Low Flow Events

Low flows in Indian River occur when sustained high-pressure weather systems produce fair weather in southeast Alaska. During these periods, baseflow conditions generally occur in streams throughout the entire region. These conditions can occur in any month, though the lowest flows are not likely to occur in late spring i.e., May and June, when snowmelt adds to baseflow levels. Winter low flows are usually the lowest flows experienced annually in Indian River. Indian River's lowest annual flows have occurred during the winter months in 13 of the 17 years of stream gaging (72% of time). Summer and winter low flows average the same flow rate at 19.2 cfs each. The lowest recorded one-day flows in Indian River have occurred in winter months.

Water Quality

The USGS is currently studying water quality in Indian River in cooperation with the National Park Service. This study is examining water quality at both upstream areas where the basin is relatively pristine and downstream sites where development in the basin could affect water quality. Upstream and downstream areas have shown similar water quality throughout the range of flows where water quality measurements were made. Preliminary results of the draft USGS study indicate that Indian River has suffered minimal water quality impacts from development (USGS, 2003), although the study results may not be comprehensive enough to accurately forecast development influences on water quality throughout the study area. Water quality in Indian River can be generalized as follows:

- Indian River has a low buffering capacity with concentrations of dissolved ions and nutrients generally low in both the upstream and downstream sites. Total Alkalinity expressed as $CaCO_3$ ranged from 10 to 15 mg/l.
- Dissolved oxygen concentrations ranged from 11.2 to 14.1 mg/l and were nearly both equal at the upstream and downstream locations.
- Concentrations of major ions and dissolved solids were low at both sites.
- Nutrient concentrations (Nitrogen ions and Phosphorus) were low at both sites.
- Suspended sediment concentrations are low at both sites. Suspended sediment concentrations ranged from none detected to 4 mg/l and varied little between the two sites. Suspended sediment concentrations were higher when flows were higher in Indian River.

Development Influences

Existing development affects runoff processes in the Indian River basin. Roads and impervious areas associated with residential subdivisions provide a source of sediment and increase the volume and rates of stormwater runoff. Various contaminants can be adsorbed to sediment particles and conveyed to the stream by storm runoff.

Table 2: Annual Peak Flood Events for POR by Month

Event Rank	Discharge (cfs)	Month
1	6460	November
2	5710	September
3	5390	October
4	5080	August
5	4560	October
6	4060	November
7	3860	February
8	3320	October
9	3320	September
10	3270	December
11	3090	October
12	3080	October
13	2940	February
14	2820	October
15	2600	September
16	1780	January
17	1580	September

Table 3: Seasonal Occurrence of Annual Peak Flows

Month	No. of Annual Peak Flow Events	% of total Annual Peak Flows
August	1	6%
September	4	24%
October	6	35%
November	2	12%
December	1	6%
January	1	6%
February	2	6%

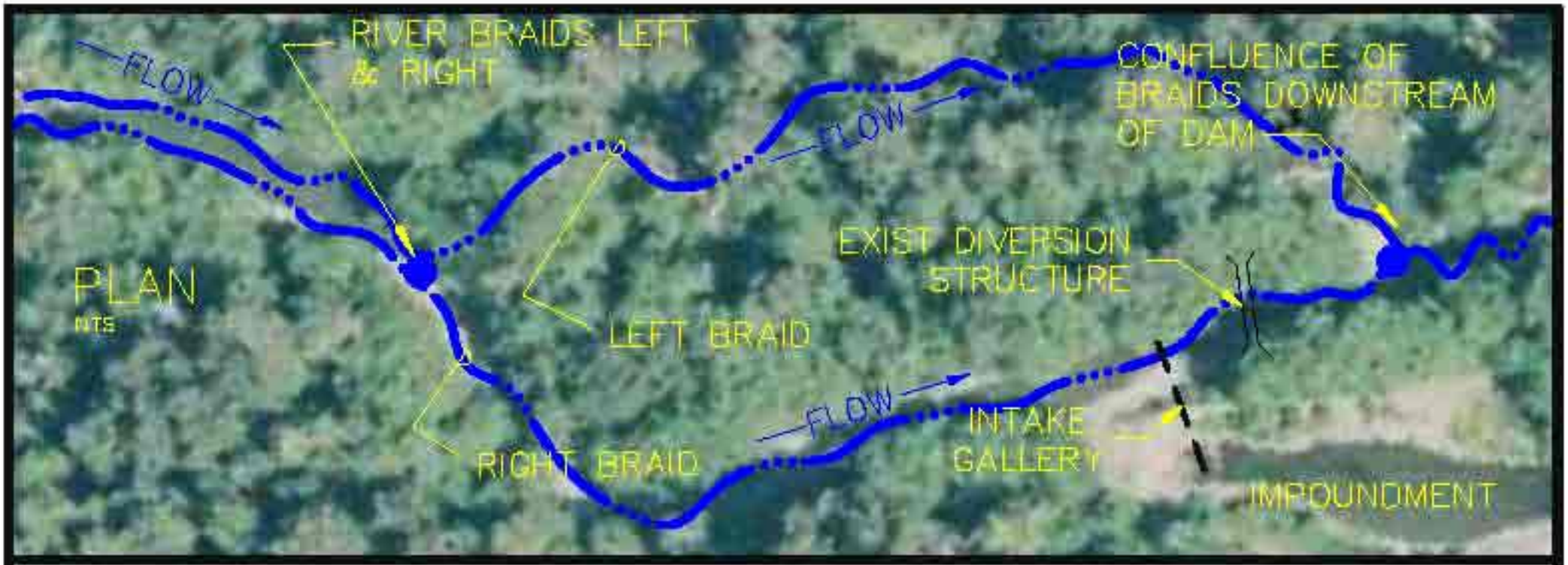
The existing drainage system employs several stormwater Best Management Practices (BMPs). These BMPs include stormwater detention ponds that reduce peak post-development flow rates and promote deposition of particulates that may carry adsorbed contaminants. Construction is ongoing in the subdivisions and several construction stormwater BMPs such as silt fences were observed in place during the site visit. Permanent BMPs generally appear to be in good condition. Lack of runoff during the field visits did not allow observation of BMP performance during storm-event conditions. Exposed earth in construction areas, while protected by temporary BMPs, is susceptible to erosion and transport to surface-water resources in the area and should be stabilized as soon as possible.

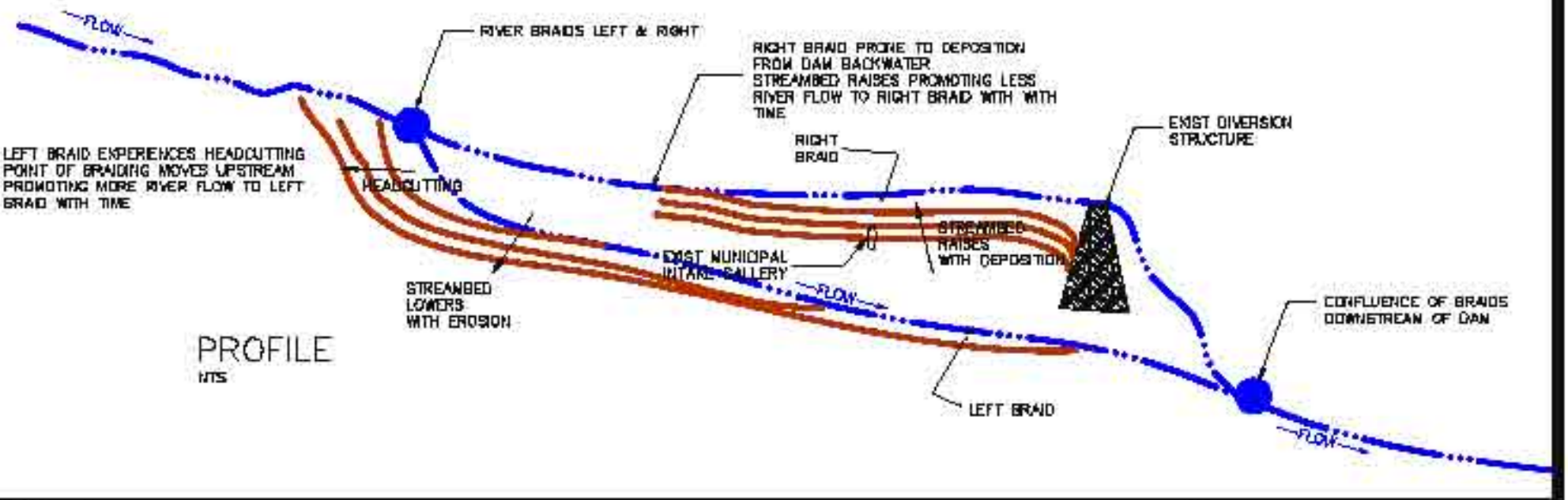
An existing culvert crosses Indian River Road at the corner of Naomi Kanosh Lane. This culvert acts as an overflow from the stormwater drainage system in the Ashaak

bypasses the CBS diversion structure. Flow entering the steeper left braid in turn leads to degradation of that channel which lowers the streambed and further encourages more flow to leave the right braid in favor of the left. If left in its current state, the channel will abandon the right braid entirely leaving the CBS secondary water source unusable. Events resulting from channel processes such as described above are extremely difficult to predict in a quantitative timeframe with any degree of accuracy; it may take several years for Indian River to abandon the right braid or it may occur as of the writing of this memorandum. Nevertheless, while the timeframe is near impossible to predict, the direction and outcome of the process are clear if left unchecked. Recent observations by the CBS Public Works Department in the fall of 2004 indicate that the river flow is split approximately 65%/35%, with the majority of the water now flowing in the left channel.

The CBS Public Works Department is currently planning minor improvements to the water intake structure, including in-stream improvements to the intake dam and infiltration piping that connects the river to the impoundment area. Preliminary estimates for renovating the intake dam and infiltration piping have been produced, and funding has been requested to be included in future budgets.

Figure 6B, page 37, illustrates the erosion and depositional river processes that are occurring in the channel at the reach where the CBS water source is located. Figures 6A, page 27, shows the braiding river channel in locations upstream and downstream of the CBS water diversion.





SCALE HOR.: 1"=100' VERT.: N/A	Figure 6B. River Erosion and Deposition Processes at CBS Intake	Keta Engineering P.O. Box 640 Craig, Alaska 99921

Findings

1. Streamflows in Indian River are highest in the fall months of September, October and November.
2. Peak floods can occur in any month though are most probable in fall months.
3. Snowmelt comprises a significant portion of the streamflow in the months of April, May and June.
4. Both summer and winter low flows occur in Indian River. Winter lows have been the annual one-day minimum flows in 72% (13) of the 17 years of record.
5. Water quality in Indian River is generally good. Water quality parameters measured in downstream areas that receive runoff from developed areas show little variation from corresponding measurements made in pristine upstream areas.
6. The existing municipal water diversion owned and operated by CBS is in jeopardy of losing its source water because the river is changing its course upstream. Such a channel change by the river would leave the existing right braid where water enters the CBS system with little or no water thus making the existing CBS diversion inoperable.
7. The river channel is braided and highly connected to its flood plain at the site of the existing abandoned log stringer bridge. These natural conditions make channel migration likely and make the site problematic for use for the proposed pedestrian bridge crossing of the river. Alternative locations should be considered for the proposed trail and bridge.

References

U.S. Department of Commerce. NOAA National Weather Service. Weather station data for Sitka Japonski Island Station 508494. 1948 through 2001.

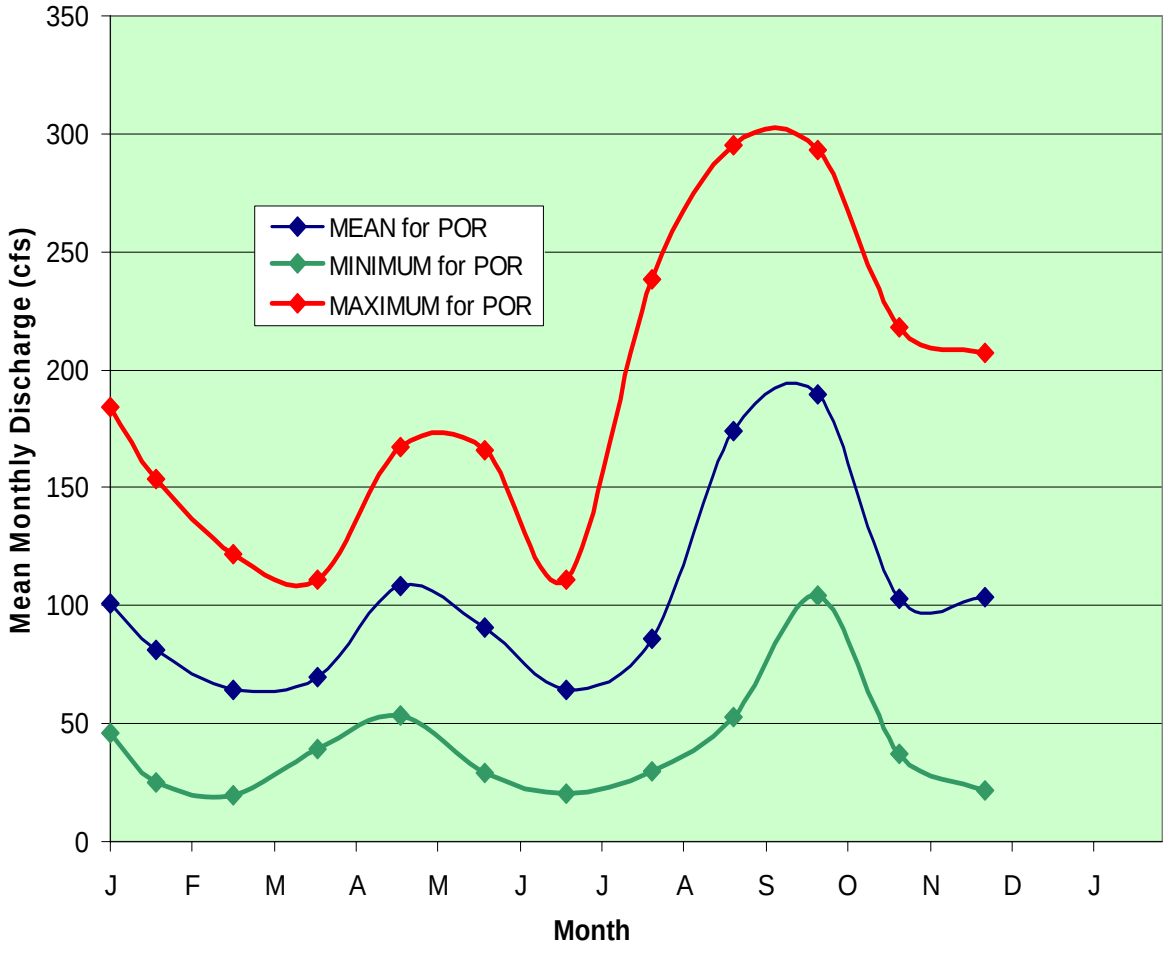
US Department of Interior. USGS. Gaging Station Data for Station 15087690, Indian River near Sitka, Alaska. Water years 1980 - 1993 and 1998 - 2001.

Paustian, S.J. and T. Hardy 1995. Aquatic Resource Survey: Indian River, Sitka National Historical Park, Alaska. USDA Forest Service, Chatham Area, Sitka AK. Prepared for US Dept. of Interior, NPS, Anchorage, AK.

US Department of the Interior. USGS. 2003. Water Quality of Indian River, Sitka, Alaska, 2001-2002. Draft report. Prepared in cooperation with US Dept. of Interior, NPS, Anchorage, AK.

Chart 1: Indian River near Sitka, Alaska 15087690

Average, Maximum and Minimum Monthly Stream Discharge



Water Rights in Sitka

In Alaska's Constitution, water was declared a public resource belonging to the people of the state to be managed by the state for maximum benefit to the public. All surface and subsurface waters on all lands in Alaska are reserved to the people for common use and are subject to appropriation in accordance with the Alaska Water Use Act. The Water Resources Section of the Alaska Department of Natural Resources (ADNR) adjudicates water rights.

What are water rights?

A water right is a legal right to use surface or ground water under the Alaska Water Use Act (AS 46.15). Water rights typically apply to withdrawals, impoundments, diversions, and for instream uses. Instream uses are for uses of water within a river or a lake and are categorized as a reservation of water, which is simply a water right for retaining a portion of water in a river or a lake. A water right allows a specific amount of water from a specific water source to be diverted, impounded, or withdrawn for a specific use. When a water right is granted, it becomes appurtenant to the land where the water is being used for as long as the water is used. If the land is sold, the water right transfers with the land to the new owner, unless the ADNR approves its separation from the land. In Alaska, because water, wherever it naturally occurs, is a common property resource, landowners do not have automatic rights to ground water or surface water. A water right may be subject to revocation by ADNR if it is forfeited (through non-use of five years or more) or abandoned (through non-use for any period of time with intent to abandon).

Water rights typically apply to wells and diversions, but water can also be reserved for fish and wildlife, recreation, transportation, and sanitation through a similar process called "Reserving water for instream use." A reservation of water for instream use sets aside the water necessary for these activities and keeps later water users from appropriating water that may affect the instream activity. For both water rights and a reservation of water for instream use, priority is given chronologically.

How are water rights obtained?

Water rights are obtained by submitting an application to the ADNR office in the area of the water use. In Sitka, water rights are maintained through the Juneau office of the DNR. The priority date for a water right is established on the date that the ADNR receives the application. The priority date is provisional, however, until the Permit to Appropriate Water is issued. This permit is a legal document that establishes water rights. A person with water rights has priority to use water over persons who file later for water rights from the same source. Anyone who diverts, impounds, or withdraws a significant amount of water for use, without a permit or certificate, is guilty of a misdemeanor (AS 46.15.180).

Water Rights Ownership in Sitka

Four entities hold generally recognized water rights on the Indian River. They are the City and Borough of Sitka (CBS), Sheldon Jackson College (SJC), the National Park Service (NPS) and the Alaska Department of Fish and Game (ADF&G). These water rights are summarized in Table 4 on page 43.

CBS has been granted only one water right, ADL 43672, and an application for an additional Right, ADL 101686, has not been granted. The CBS water right is used for a public water supply. Although the primary water supply for the city is the Blue Lake Reservoir, Indian River does provide a backup water supply during emergencies and during regularly scheduled maintenance on the Blue Lake Dam. Although seldom used, the Indian River water intake is a vital and necessary part of the city infrastructure. CBS has one certified water right and one unapproved application on the Indian River for a total of 6 million gallons per day for public water supply.

Sheldon Jackson College initially used its water rights, up to 30 cubic feet/second, to provide water for both hydropower and a fish hatchery. There is some dispute as to how much was allocated for each, and there has been no formal adjudication of this issue. Water is diverted through a small dam and flume to the SJC fish hatchery and hydropower facility. The hydropower facility has not operated since 1988.

The Alaska Department of Fish and Game water right reserves instream flows for spawning, incubation, and rearing of salmon for the Indian River from the mouth as it enters tidewater at the extreme low tidal stage of Jamestown Bay upstream to river mile 2.5. The right reserves a seasonally variable flow ranging from 35 cubic feet per second (cfs) during December 1st through April 15th to 101 cfs during October 1st through the 15th. It should be noted that the ADF&G water right has a later priority date and is considered junior to the CBS and SJC water rights. The ADF&G water right does not constrain CBS or SJC in their right to withdraw water up to their permitted flow. The ADF&G water right is only legally effective against a later appropriator.

In addition to the water rights held by CBS, SJC, and the ADF&G, the National Park Service (NPS) claims an inchoate, unquantified, Federal Reserved water right for instream flows on the Indian River to maintain fish habitat, recreational use and historic interpretation. The NPS claims a priority date of 1890, the date when the Sitka National Monument was established. To date, ADNR has not adjudicated the NPS right. It is possible that legal action may eventually be undertaken to clarify and establish water rights on the Indian River. It is not unusual for water rights litigation to be very time consuming, and it may be years before the final adjudication is completed. In the meantime, the NPS has approached Sheldon Jackson College to see if the College is interested in selling a portion of the water right on the Indian River to resolve long-standing resource protection issues. This issue has yet to be resolved.

Table 4: Water Rights at Indian River

Name and File Number	Water Right or Reservation	Priority Date	Quantity
Sheldon Jackson College ADL 43671	**Water Right**	**12/31/1914**	**30 cfs**
City and Borough of Sitka ADL 43672	**Water Right**	**12/31/1914**	**2,500,000 gpd**
City and Borough of Sitka ADL 101686	**Application***	**9/23/80**	**3,500,000 gpd**
National Park Service, Sitka National Historic Park	**Implied federal reserved water right.**	**1890**	**Unadjudicated**
Department of Fish and Game LAS 12236	**Reservation**	**1/12/89**	**Varies seasonally**

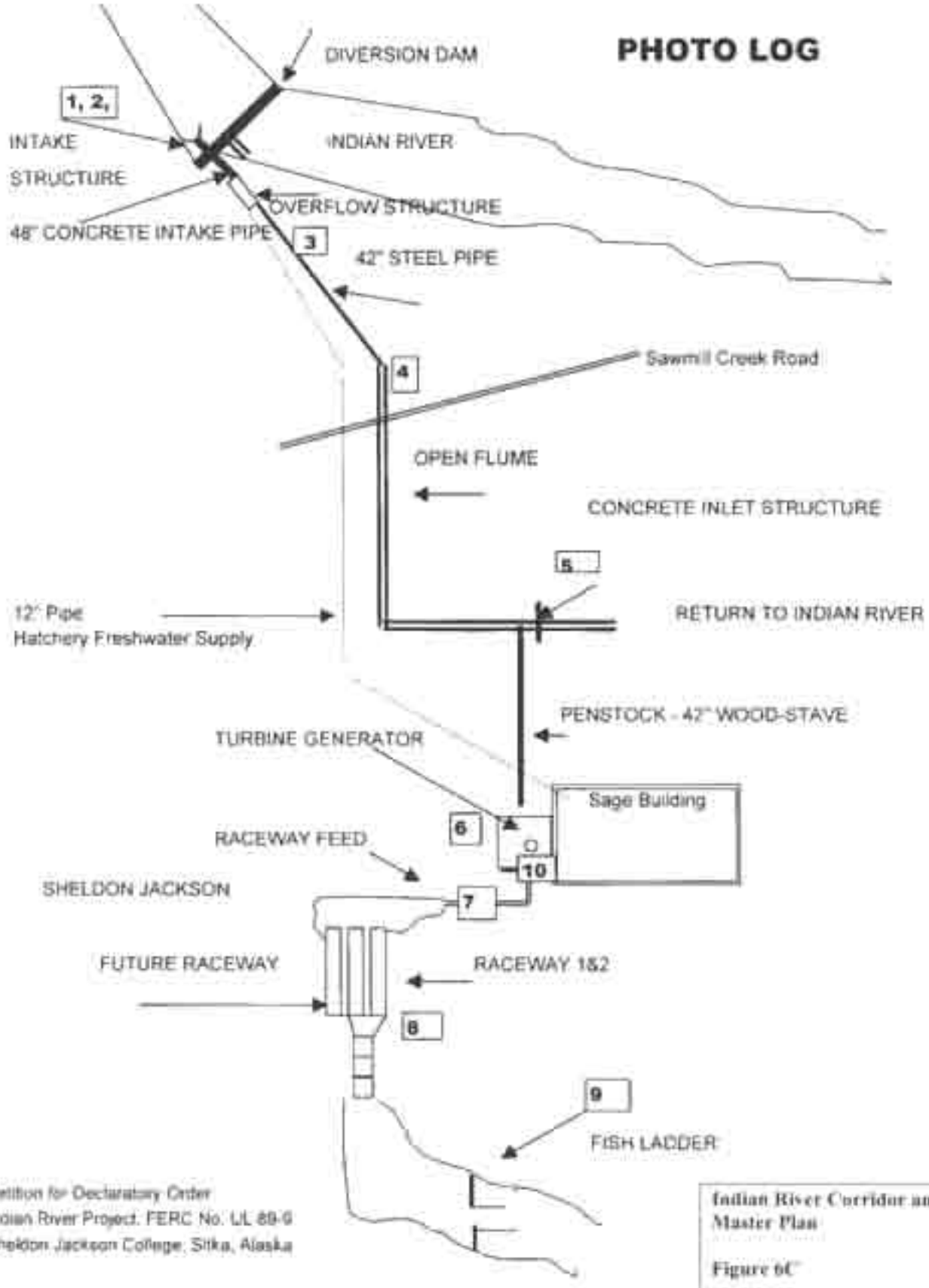
***This application has not been granted.**

Hydropower

There was one hydropower facility in the Indian River Watershed, which was operated by Sheldon Jackson College. Initially established in the 1920's, the hydropower plant provided electricity to SCJ until 1988 when it was shut down for maintenance and rehabilitation. A schematic diagram of the hydropower system is shown on Figure 6C, page 46. This drawing was obtained from the Federal Energy Regulatory Commission (FERC) Online website, http://www.ferc.gov/docs-filing/elibrary.asp.

Water for the hydropower facility was impounded at the dam upstream and flowed through a combination piped and open channel flume. A photo of the pipe flume is shown at right. The impoundment dam and flume were recently improved during the summer of 2003. The water flows to both the fish hatchery and the electric turbine facility. The hydropower system has been shut down since 1988, although SJC has funding available for upgrades in the form of a grant given to CBS by the U.S. Department of Energy in 2001. SJC has requested that it be exempted from FERC jurisdictional regulations regarding hydropower generation, and to date FERC has denied its petition. It is not known when, if ever, the hydropower station will be put back into service. If the SCJ hydropower water rights were revoked by ADNR as a result of non-use (forfeited), the hatchery water right would remain to the extent it could be shown that water withdrawn from Indian River had continued in use for hatchery purposes. Forfeiture of the SCJ hydropower water rights would require adjudication by ADNR.

Water withdrawals for hydropower use compete with other uses of Indian River water. Water withdrawn for hydropower production should be carefully evaluated to ensure that it is the best use of the sometimes limited quantity of water available in Indian River.



Petition for Declaratory Order
Indian River Project, FERC No. UL 88-9
Sheldon Jackson College, Sitka, Alaska

Indian River Corridor and Watershed Master Plan

Figure 6C

Sheldon Jackson Hydropower Schematic
(From FERC Online File Retrieval System)

Chapter 4: Recreational Trails and Historical Sites

The Indian River Watershed is a significant recreational and historical resource to Sitka. Fishing, hiking, camping, hunting, berry picking and subsistence gathering and trapping, and mining activities have all taken place in Indian River at various times in Sitka's history. Although the current usage of the watershed today is primarily hiking and hunting, in the past the river valley was a significant resource to the early settlers and the indigenous people of the Sitka region. A map of the trails and historical areas within the Primary Study Area has been developed, and is shown as Figure 7 on page 48.

Of interest outside of the Primary Study Area in the north end of the valley is the Cascade Claim gold mine, located in Billy Basin on the east fork of Indian River. Although the Cascade Claim was never a significant source of gold, it is described in the 1912 USGS Bulletin 504 on the Sitka Mining District as one of the only ore deposits discovered in the near vicinity of Sitka. The mine has been inactive for many years.

The Sitka National Historical Park was established at the mouth of Indian River in 1890 by President Benjamin Harrison as a public park to commemorate the battle between the Russians and the Kiks.ádi Tlingit, known as the Battle of Sitka. The park eventually evolved to a Monument in 1910, then reached National Park status in 1972.

The Sitka Tribe of Alaska was asked to participate in identifying historical sites and items of particular cultural importance to them as part of the Master Plan project. The following paragraph was provided by STA for inclusion in the Master Plan, and is taken from an archaeological report of a site adjacent to Indian River written by Robert Betts1

> Ethnographically, the Kiks.adi clan is known to have used Indian River (called Kahsdahin (Kaasda Heen) in Tlingit) and its drainage for salmon fishing (pink, coho, and chum salmon all spawned in Indian River), deer and brown bear hunting, berry picking (currants and blueberries) and eventually trap lines (Goldshmidt and Haas (1946:108). The Point House traditionally gathered a variety of plants in the vicinity of Indian River in May and June. Plants collected included wild celery, salmonberry sprouts, seaweed and another leafy green plant that grows along the beach (Herb Hope (1992:3)). A few bark-stripped spruce are present in Sitka National historical Park but it is not known how far upstream along Indian River this activity may have occurred. A major subsistence resource for the Tlingit was the herring run in Sitka Sound. Goldschmidt and Haas (1946: 118) report that "in the old days there were many smokehouses at the mouth of the river and the native village of Sitka extended from the mouth of the river to Jamestown Bay." As late as 1880 a population of 43 Tlingits were reported to occupy a seasonal fish camp at the mouth of Indian River.

[1] *Archaeological Clearance Survey Indian River Subdivision Lot # 2, Sitka, Alaska June 1996*

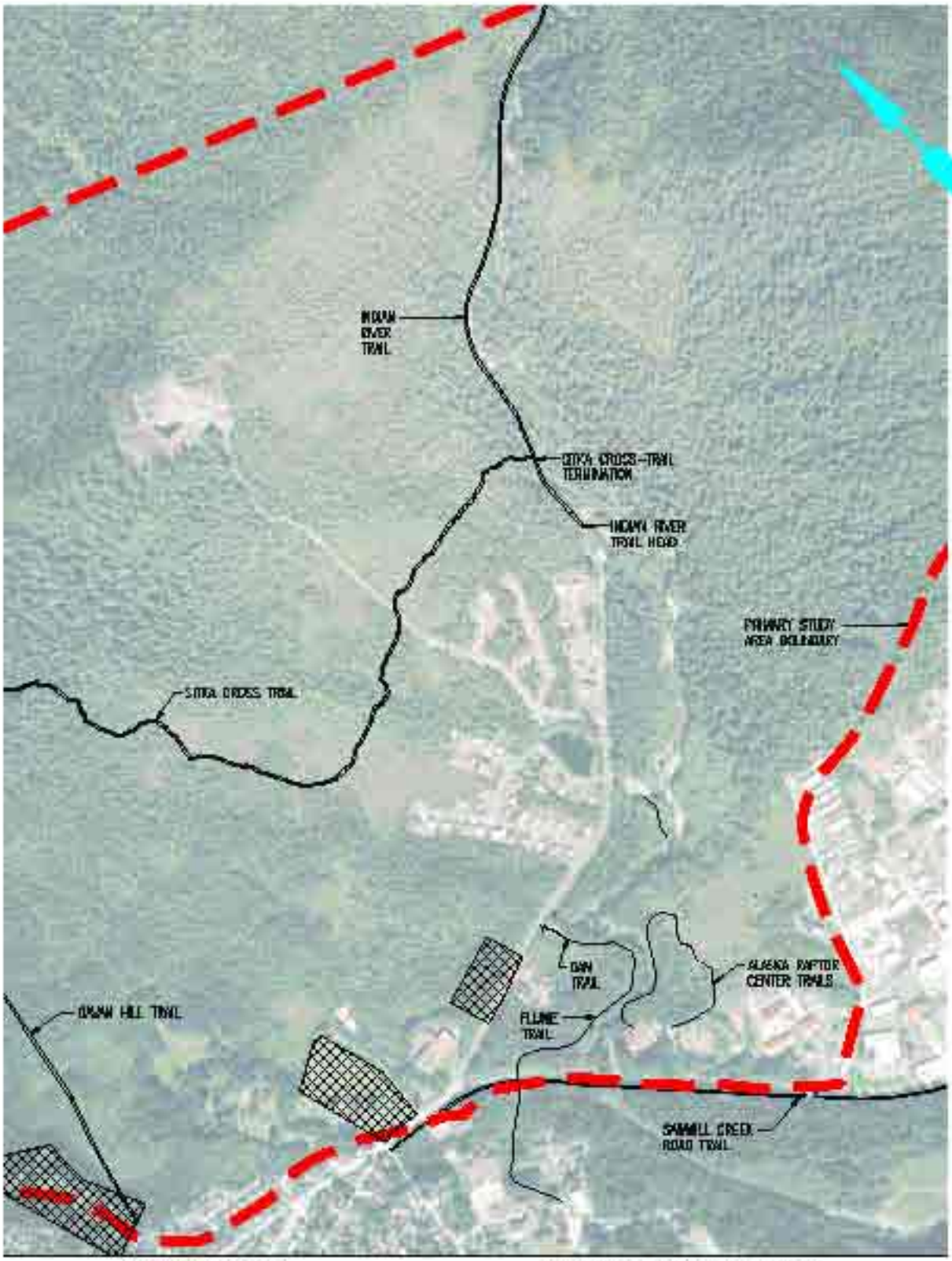
Indian River and the immediate areas of the watershed are one of the most culturally important sites for Sitka tribal citizens. The Sitka Tribal Council met and discussed their history as it relates to Indian River. They noted that seasonal native camps and smokehouses historically existed at the mouth of Indian River and today people continue to hunt deer, pick berries and gather other wild plants in the watershed. They specifically identified three sites with historical and cultural significance: The Indian River Cemetery, an ancient village site, and the location of the origin of the Woman Who Became an Owl legend. The last two sites are not specifically identified on the map but are located within the Indian River Watershed. The Tribal Council passed a resolution supporting protection of the Indian River Watershed as historically and culturally important to the Tribe. Their efforts are very much appreciated. A copy of this Resolution is included in this chapter on pages 53 and 54.

Sport fishing is also a recreational activity on Indian River, primarily for steelhead, Dolly Varden and cutthroat trout. Indian River and other salmon streams along the local road system are closed to both sport and subsistence salmon fishing. Recent improvements in pink salmon stocks may permit the Alaska State Board of Fish to reopen them for some limited salmon fishing.

Hunting is also an important activity in the watershed, and deer hunting in particular is popular. To a lesser extent, bear hunting and smaller game animal trapping also takes place, but deer hunting remains the most common hunting activity.

Sitka has an extensive trail system, with the Sitka Cross Trail being one of the most popular non-motorized trails. The Cross Trail connects from the west to the Indian River trail near the CBS water intake facility. The Indian River Trail starts at the upper end of Indian River Road and goes up the Indian River Valley to the falls on the east fork of the river. Gavan Hill Trail also crosses through the west side of the watershed.

In addition to those popular trails, the Alaska Raptor Center has a network of trails on its property on the east side of Indian River. Its trails are extensively used by visitors to the Raptor Center, but get less use from the general Sitka population.



EXISTING TRAILS

SITKA CROSS-TRAIL
DAM TRAIL
GAVAN HILL TRAIL
INDIAN RIVER TRAIL
ALASKA RAPTOR CENTER TRAIL
SAWMILL CREEK ROAD TRAIL
INDIAN RIVER TO VERSTONIA TRAIL
FLUME TRAIL

HISTORICAL/CULTURAL SITES

CEMETARIES

ADDITIONAL CULTURAL SITES ARE LOCATED IN THE WATERSHED. REFER TO SITKA TRIBE OF ALASKA ORAL FOR ADDITIONAL INFORMATION.

SUMMIT CONSULTING SERVICES Inc.

INDIAN RIVER CORRIDOR AND WATERSHED MASTER PLAN

CITY AND BOROUGH OF SITKA, ALASKA

TRAILS AND HISTORICAL AREAS

FIG 7

Sitka Tribe of Alaska
456 Katlian Street
Sitka, Alaska 99835

907-747-3207
Fax: 907-747-4915

Tribal Council Resolution 54-2004

Resolution Regarding Historic and Cultural Importance of Indian River Watershed Area

WHEREAS, the Sitka Tribe of Alaska is the federally recognized tribal government for more than 3,100 enrolled tribal citizens in Sitka, Alaska organized under the Indian Reorganization Act of 1934 as amended; and

WHEREAS, the Sitka Tribe of Alaska is responsible for the health, safety, welfare and cultural preservation of its tribal citizens and their use of the Sitka Tribe's traditional territory; and

WHEREAS, the Sitka Tribe of Alaska's traditional territory reflects the lands and waters historically and presently the stewardship responsibility of the Sheet'ka Kwaan and as such are composed of the western side of Baranof Island, the greater reaches Peril Strait, southwestern portions of Chichagof Island and the myraid of islands as well as the waters between these locations; and

WHEREAS, the Indian River watershed is within the traditional territory of the Sitka Tribe; and

WHEREAS, the Cultural Committee of the Sitka Tribe of Alaska consists of tribal elders and cultural bearers of the Sitka Tribe and is called upon to address cultural issues of the Sitka Tribe and has thus forwarded this resolution to the Tribal Council for consideration; and

WHEREAS, the City and Borough of Sitka has requested input regarding the historical and cultural significance of the Indian River Watershed in order to incorporate such knowledge in the development of the Indian River Watershed Master Plan, and

WHEREAS, the Cultural Committee of the Sitka Tribe of Alaska recognizes the Indian River Watershed as an important cultural resource for its historical significance to the people of the Sheet'ka Kwaan, for subsistence gathering of resources, and because several important events of the Sheet'ka Kwaan occurred within the watershed.

NOW THEREFORE BE IT RESOLVED, that the Sitka Tribe declares that three important cultural sites are located in the Indian River watershed area and should be protected from development, including protection by the City and Borough of Sitka's recognition of them as a historic site. These sites are the Indian River cemetary and burial grounds, an ancient village site, and the location of the origin of the Women Who Become an Owl Legend; and

BE IT FURTHER RESOLVED, that the Sitka Tribe of Alaska declares that Indian River and the flat land surrounding the river are vital to the deer population of the area which is crucial to the subsistence lifestyle of the Native people of Sitka, and thus such habitat should be avoided as much as possible when considering development options for the Watershed; and

NOW THEREFORE BE IT FINALLY RESOLVED, that the Sitka Tribe of Alaska declares that the run of coho and humpy salmon are culturally vital to our people, and several salmon runs have already been terminated, and the health and water quality of Indian River is important to the coho and humpy salmon population, and the salmon runs of Indian River must be protected from this day forward from development impacts, including erosion

CERTIFICATION

The foregoing Resolution was adopted at a duly called and convened meeting of the Tribal Council of the Sitka Tribe of Alaska held on **February 18, 2004**, at which a quorum was present by a vote of **_9_In Favor, _0_, Against _0_Abstain, _0_Absent.**

Sitka Tribe of Alaska - Tribal Vice-Chairman

Attest

Sitka Tribe of Alaska - Tribal Secretary

Chapter 5: Wetlands

Wetlands predominate within the Primary Study Area. Virtually all of the remaining undeveloped land in the Primary Study Area can probably be classified wetlands as defined by the US Army Corps of Engineers (USACE), which regulates development of wetlands. However, it may be useful for potential development plans to identify, within certain broad categories, the types of wetlands that may be encountered in specific areas. As part of the Inventory process, some informal mapping was performed within the Primary Study Area to identify potential wetland types. It should be stressed that the mapping that was performed for the Master Plan is not an official wetlands determination which will be required for specific development projects within the watershed.

The wetlands classifications used in the mapping are loosely based on the definitions used for the Granite Creek Soils Probe and Wetlands Investigation, performed by Stephl Engineers for HDR Alaska and Kean and Associates as part of the Granite Creek land clearing landfill development project. Since a detailed wetland mapping process was beyond the scope of the Indian River Master Plan, the wetland types were narrowed to three general classifications - Forested, Muskeg, and Riparian, and one non-wetland classification, Uplands. The results of the informal mapping are shown on Figure 8, page 61.

The general wetland classifications are as follows (excerpted and paraphrased from the Stephl Wetlands Investigation report):

Open Muskeg Wetlands

These sites are on the flattest ground within the Primary Study Area. They are saturated to the surface and often include small ponds. The soils are organic, with peat soils predominating. Although peat probes were not undertaken, it is common to find peat layers up to 15 feet thick in this area. Muskeg wetlands are found in patches of up to 20 acres in size throughout the Primary Study Area. Muskeg wetlands will require wetland development permits.

Forested Wetlands

This classification includes both open canopy and closed canopy spruce and hemlock forests on undulating lands and slopes of up to 40%. Most of the forested undulating terrain (up to 15% slopes) will generally be classified as wetlands, and some if not all of the forested lands between 15% and 40% slopes will be classified as wetlands, although some may qualify as marginal uplands. These areas are most likely to require specific wetlands classifications prior to any development.

Riparian Areas

Although not specifically having the types of vegetation and soils found in other wetland classifications, these areas along the river channel are periodically flooded during times of high flow in Indian River. Because the Corps of Engineers has jurisdiction over even small and intermittent stream channels, a permit from the Corps is likely to be needed for any development within this area.

Uplands (Non-wetlands)

The Uplands classification generally includes hemlock or spruce-hemlock forests on steep slopes. These areas are characterized by relatively well-drained soils, with large stands of hemlock and spruce. These forested areas are generally found along the eastern and western edges of the watershed, above the valley floor. Although not classified as wetlands, much of this land may be difficult to develop due to steep terrain.

Regulation of Development in Wetlands

The US Army Corps of Engineers (USACE) regulates wetlands development and is responsible for issuing permits through Section 404 of the Clean Water Act. Currently, the USACE defines wetlands as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. "Wetlands generally include swamps, marshes, bogs, and similar areas." (Corps of Engineers Wetlands Delineation Manual) As noted earlier, virtually all of the land within the Primary Study Area will most likely be classified as wetlands under this definition.

Typical Activities that Require a Wetlands Permit (Section 404) Include:

- Discharging fill or dredged material in waters of the U.S., including wetlands.

  Fill material includes garbage, rock, sand, soil, clay, plastics, construction debris, wood chips, overburden from mining or other excavation activities, and materials used to create any structure or infrastructure in a wetland. Land clearing operations involving vegetation removal with mechanized equipment such as front-end loaders, backhoes, or bulldozers with sheer blades, rakes, or discs in wetlands; or windrowing of vegetation, land leveling, or other soil disturbances are considered placement of fill material under Corps of Engineers jurisdiction.

- Site development fill for residential, commercial, or recreational developments.
- Construction of revetments, groins, breakwaters, levees, dams, dikes, and weirs.
- Placement of riprap and road fills.

Who Needs a Wetlands Permit

A wetlands permit is needed by any person, firm, or agency planning to discharge, dump, place, or deposit material in a wetland. The permitting process can be lengthy, requiring between 30 days and six months depending on the type of permit. Wetlands permits must be obtained before any site development occurs. In order to avoid delaying construction, an application for a wetlands permit should be sent to the USACE during the early design phase of the project. USACE has legal authority to enforce violations of the Clean Water Act and constructing without the appropriate permits can result in fines, an expensive restoration project, or legal action. If you are planning a project, USACE should be contacted to confirm if a wetlands permit is required.

The Permitting Process

When planning development in the Indian River Corridor, the following steps should be taken to comply with wetlands regulations.

1. Determine if any land affected by the project is a wetland. If the extent of the wetlands is unknown, a Wetlands Delineation can be performed to define the location of the wetlands. Wetlands Delineations must be performed by a certified professional and approved by the USACE.
2. Develop a concept level project description that describes where the development is located, the size of the development (in acres), and how many yards of fill material will be used. A site plan, drawn from an aerial perspective, will be needed when corresponding with the USACE.
3. Contact the USACE, Regulatory Division, for a permit application. Even if the site is not a wetland, it is prudent to discuss the development with the USACE so that they can determine whether a permit is or is not needed.
4. Submit the project description, drawings, and permit application to the USACE during the early design phase of the project. USACE has a minimum of thirty days to review the application.
5. Submit any additional permit applications or forms, such as a Fish Habitat permit or Coastal Project Questionnaire.

The USACE regulatory division can be contacted in Anchorage.

Telephone:
Toll Free from within Alaska: (800) 478-2712
Anchorage or Outside Alaska: (907) 753-2724
Fax: (907) 753-5567

Mailing Address:
U.S. Army Corps of Engineers
Regulatory Branch
P. O. Box 6898
Elmendorf AFB, Alaska
99506-6898

Physical Address (Express Mail):
2204 3rd Street
Elmendorf AFB, AK 99506

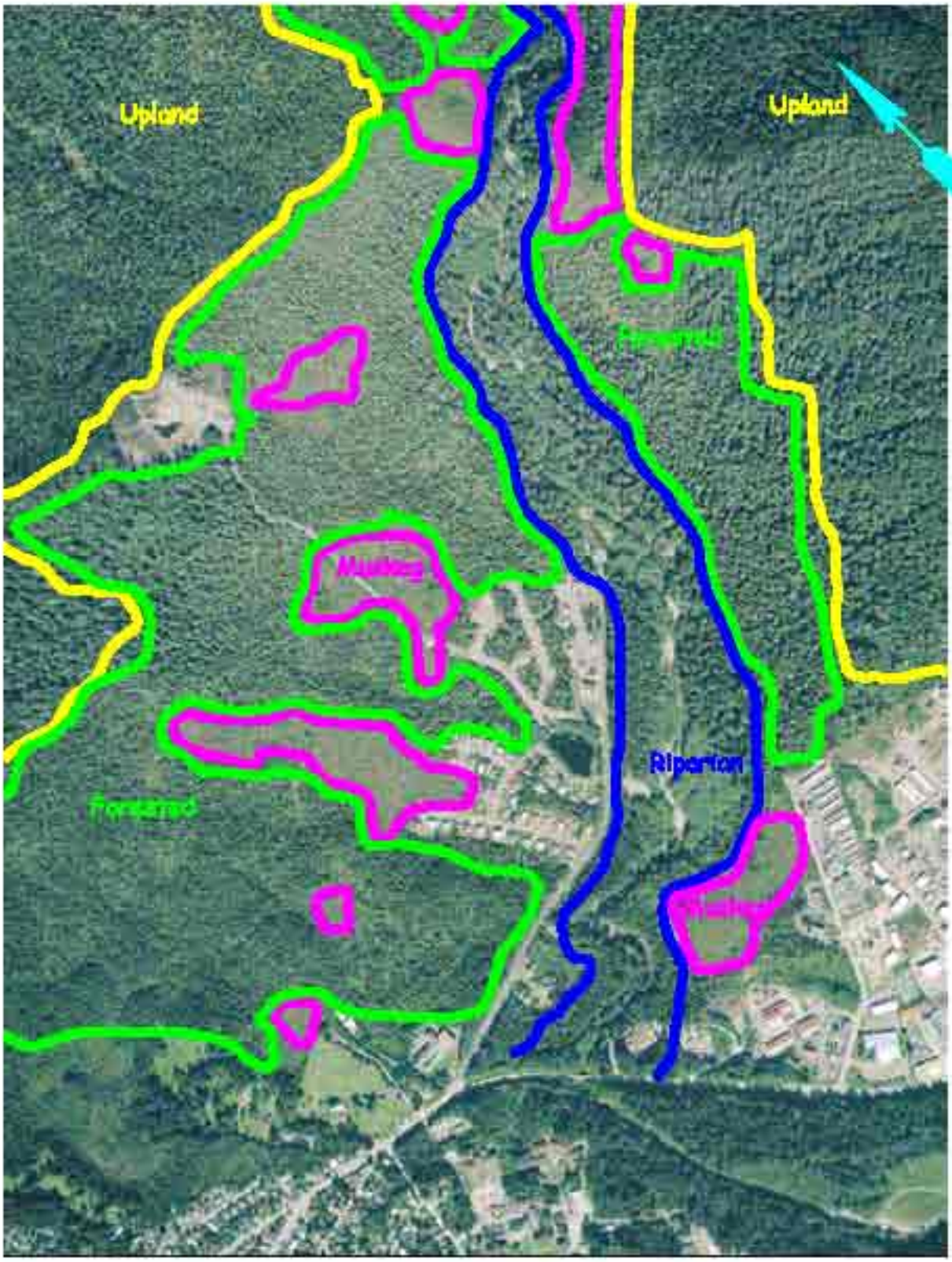
Web:
http://www.poa.usace.army.mil/reg/default.htm

Send mail to: regpagemaster@poa02.usace.army.mil

For more information about the Coastal Project Questionnaire and Fish Habitat Permits, contact the ADNR in Juneau.

Additional Permits May be Needed

It is important to note that other regulatory agencies may require additional permits or procedures for the development. Almost any project in Sitka will need to submit a completed Coastal Project Questionnaire to the ADNR. The Coastal Project Questionnaire is not a permit. Instead, it is a fill-in-the-blank survey that is used by the State to make sure that the development is pursuing all of the necessary state and federal permits. The Coastal Project Questionnaire does have its own approval period, typically lasting between 30 and 60 days for small projects. In addition to the Coastal Project Questionnaire, any development that could impact a waterbody may need an ADNR Fish Habitat Permit.



WETLANDS LEGEND

- UPLAND AREAS (NON-WETLANDS)
- FORESTED WETLANDS
- MUSKEG WETLANDS
- RIPARIAN WETLANDS

NOTE:

WETLAND BOUNDARIES ARE APPROXIMATE, AND WETLAND CLASSIFICATIONS ARE BASED ON CURSORY FIELD AND PHOTO INTERPRETATIONS.

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INDIAN RIVER CORRIDOR AND WATERSHED MASTER PLAN

CITY AND BOROUGH OF SITKA, ALASKA

WETLANDS

FIG 5

Chapter 6: Utility Infrastructure

This section of the Master Plan Inventory deals with the existing utility infrastructure in place in the Indian River Watershed. The systems inventoried include:

- Water Supply
- Water Distribution
- Sewer Collection
- Roads
- Electrical and Lighting Systems
- Communications and Cable TV

The Inventory is not intended to be an extensive analysis of the condition and serviceability of the infrastructure, but rather a brief summary of the type and extent of the systems within the watershed.

A map of the water and sewer systems is shown in Figure 9A, page 67, and a map of the lighting, electrical power and telecommunications and cable TV systems is shown on Figure 9B, page 69.

There are several subdivisions in the Indian River Watershed that are served by municipal utility systems. Most of the subdivisions have been developed by the Baranof Island Housing Authority.

Water

The water system in the Indian River subdivisions is connected to the main water system coming from the Blue Lake Reservoir that is located approximately ten miles east of Sitka. The water is chlorinated and piped 5.3 miles through 24" and 30" transmission pipes, and reaches the main part of Sitka proper by following Sawmill Creek Road. The CBS stores water in two tanks within the distribution system that have a total capacity of approximately two million gallons.

The main 18-inch cast iron pipe (CIP) water supply line that serves the Indian River subdivisions branches off of the 24-inch Blue Lake transmission main west of Indian River Road and backtracks east along Sawmill Creek Road to the intersection with Indian River Road. It then goes north up Indian River Road all the way to the Water Intake Facility at the north end of the road. Smaller branch lines of 6, 8 and 12-inch diameter ductile iron pipe traverse through the subdivisions, connecting back together to permit back feeding the residences, increasing reliability and fire flow capability. Pamco Subdivision on the east side of Indian River Road is supplied with a single 6-inch line. The entire water main layout, including pipes sizes is shown on Figure 9A, page 67.

The CBS Water Intake Facility at the end of Indian River Road serves as the backup water supply for the City in the event that the Blue Lake Reservoir or the transmission main are out of service. The Water Intake Facility, when put into service, backfeeds through the 18-inch main to the Blue Lake transmission main. Pumps located in the facility draw water from beneath the reservoir that is fed by an infiltration gallery beneath Indian River. The water is disinfected with chlorine and then pumped back into the transmission main along Sawmill Creek Road.

Under normal circumstances, the standby facility is seldom used. However, it is regularly tested and kept in good operating condition. A planned shut down of the Blue Lake Reservoir in the spring of 2005 will necessitate putting the standby intake facility into service for up to a month or longer to complete repairs and maintenance on the dam.

Concerns have been expressed by the Public Works staff regarding sanitary conditions at the small reservoir adjacent to the Indian River Intake. The main Indian River Trail goes past the facility, and there is a good potential for contamination of the water supply. Fencing is being considered to protect the facility and to provide more security.

One issue that must be addressed if expansion of the water system along Indian River is considered is system water pressure. The Blue Lake reservoir provides water pressure as a function of elevation head. System pressures will drop as a function of distance from the reservoir, pipe size, elevation and flow. At some point it may be necessary to either provide booster pumps on the system or to install an additional water storage reservoir located at a sufficiently high enough elevation to provide adequate head pressure. CBS is currently calibrating a computer model of the water system. This will allow water demands and system pressure to be analyzed and provide solutions to low flow and low pressure situations that may occur as the system expands.

Sewer

Sewage along Indian River flows though a series of gravity sewer mains in the upper reaches of the subdivisions to a lift station located on Indian River Road near the intersection with Andrew Hope Street. From there the lift station pumps the sewage south along Indian River Road in a pressurized force main. Another small lift station collects wastewater from Pamco Subdivision and pumps it into the force main on Indian River Road. The force main on Indian River Road connects into the 10-inch ductile iron pipe sewer interceptor that runs along Sawmill Creek Road. Through a series of gravity mains, lift stations and pumped force mains, the sewage eventually reaches the Wastewater Treatment Plant located on Japonski Island. The plant provides primary treatment to the sewage, and the effluent is gravity piped through a 24" outfall to an underwater discharge near the southeast end of the airport runway. Figure 9A on page 67 shows the existing sewer system.

Roads

There are a number of paved and unpaved roads and streets that serve as access through and into the Primary Study Area. The largest is Sawmill Creek Road, crossing Indian River at the northern edge of the Sitka National Historical Park. This is a two-lane paved secondary highway that is maintained by the State of Alaska department of Transportation and Public Facilities. On the east side of Indian River is Jarvis Street, a paved road that provides access to the Solid Waste Transfer Station, the Borough Animal Shelter, and the subdivision located on the east side of Jarvis Street.

Indian River Road, on the west side of the river, provides access to the residential subdivisions, to the CBS Water Intake Facility, and to the Indian River Trail. Indian River Road is not paved, and is maintained by the City. Most of the residential subdivision roads are unpaved minor residential streets that serve only the residential areas. An exception is Yaw Drive, which connects at the northern end to an unpaved

road that provides access to the quarry near the northern edge of the Primary Study Area. There is concern among the residents that commercial truck traffic poses safety and noise problems, and is generally incompatible with the residential character of the neighborhood.

Electrical & Telecommunications

Power to the Indian River area is supplied from CBS-owned aerial and underground primary electrical distribution system. The main electrical distribution line runs west along Sawmill Creek Road from the electrical substation on Jarvis Street. Primary power is overhead down Indian River Road to near the end of the road at the Water Intake Facility. The side roads in the subdivision are served by underground feeders, with pad-mounted transformers. Luminares for roadway lighting are attached to the main utility poles along Indian River Road, and extend in underground conduit to individual light poles within the subdivisions. A map of the overhead and underground electrical distribution system is shown in Figure 9B on page 69. Figure 9B also includes street rights-of-ways and some easements.

Alaska Communications Systems provides telephone service, and cable television is provided through GCI. Most of the telephone and television cable in the subdivisions are underground systems, and follow the same general layout as the underground electrical distribution system. Like the primary electrical system, they reach the subdivisions overhead down Indian River Road, utilizing the same utility poles serving the electrical system. Overall, the electrical, lighting and telecommunications equipment is relatively new, and expansion of the system to new subdivisions should be relatively straightforward.

LEGEND

- WATER
- SEWER
- SEWER FORCE MAIN
- PRIMARY STUDY AREA BOUNDARY

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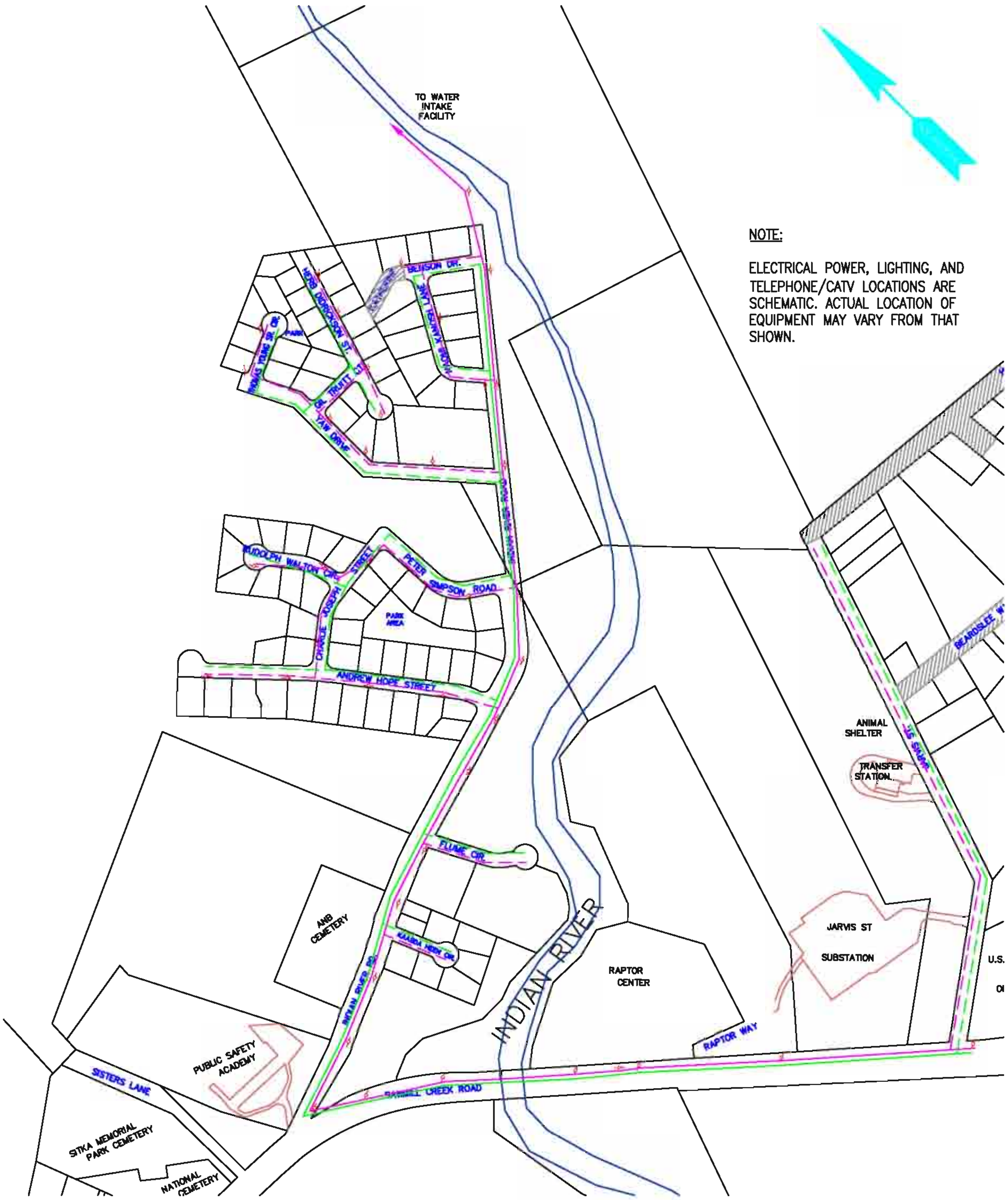
CITY AND BOROUGH OF SITKA, ALASKA

UTILITY INFRASTRUCTURE - WATER AND SEWER

FIG 8A



NOTE:

ELECTRICAL POWER, LIGHTING, AND TELEPHONE/CATV LOCATIONS ARE SCHEMATIC. ACTUAL LOCATION OF EQUIPMENT MAY VARY FROM THAT SHOWN.

LEGEND

OVERHEAD POWER	(solid magenta line)
OVERHEAD TELEPHONE/CATV	(solid green line)
UNDERGROUND POWER/CATV	(dashed magenta line)
UNDERGROUND TELEPHONE	(dashed green line)
POWER/LIGHT POLE	(pole symbol)

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INDIAN RIVER CORRIDOR AND WATERSHED MASTER PLAN

CITY AND BOROUGH OF SITKA, ALASKA

UTILITY INFRASTRUCTURE - ELECTRICAL, TELEPHONE, AND STREETS

FIG 9B

NOT TO SCALE

Chapter 7: Solid Waste

Solid waste issues and facilities in the Indian River Watershed include the Solid Waste Transfer Station, the former incinerator facility, large quantities of abandoned heavy equipment and metal debris along the edge of the river, campsite debris from illegal or informal campsites in the watershed, and overburden spoils from the rock quarry. Figure 10, page 75 shows the locations of documented solid waste sites in the watershed.

Solid Waste Transfer Facility

The existing Sitka Solid Waste Transfer Facility is located on Jarvis Street, east of the river. This facility is owned by the City and Borough of Sitka, and is used to consolidate solid waste that is collected from city residents by a commercial solid waste handling company. Waste collected at the facility is hauled elsewhere for disposal. The site is well maintained, and does not appear to be a source of detrimental solid waste problems in the watershed. The transfer station is a valuable resource for Sitka, and the continued operation is essential to addressing and solving solid waste problems in the community.

Sitka Incinerator

Incineration of solid waste debris is a commonly accepted method of reducing solid waste volume and the associated handling costs of waste disposal. The incinerator, operated for many years by the City on property leased from Sheldon Jackson College just south of Sawmill Creek Road, is now closed. The facility is no longer used for burning. Site investigations are underway at the partially dismantled facility to provide information regarding ultimate cleanup requirements and final closure of the site. Once the site is formally closed, the property will revert back to Sheldon Jackson College.

Large Equipment and Scrap Metal Debris

During field visits to the watershed, a large quantity of metal debris, consisting primarily of heavy equipment, auto and truck parts, and other substantial metal scrap was observed between Indian River Road and Indian River, across from Peter Simpson Road. Most of the debris is located on CBS property, although it is possible that additional buried debris is located elsewhere along the banks of the river or buried near or under the riverbed. It is believed that the debris is left over from commercial operations in the area, and is most likely 30 to 50 years old. It is unlikely that the debris is contributing any substantial amount of contamination to the watershed or water in Indian River, although it is unsightly and dangerous from an injury standpoint. There are potentially many tons of scrap metal debris in this area, and a cleanup will involve substantial cost and effort. If undertaken, cleanup activities must also not further damage the fish habitat along the river, particularly large-scale disturbance of gravel spawning beds and woody areas important to fish habitat.

The Sitka Tribe of Alaska (STA) has been active in efforts to both raise community awareness of the solid waste problems, and to clean up and remove solid waste debris from the watershed. The photographs in this section were used with the permission of James Craig, an STA tribal citizen who has been instrumental in solid waste cleanup activities.

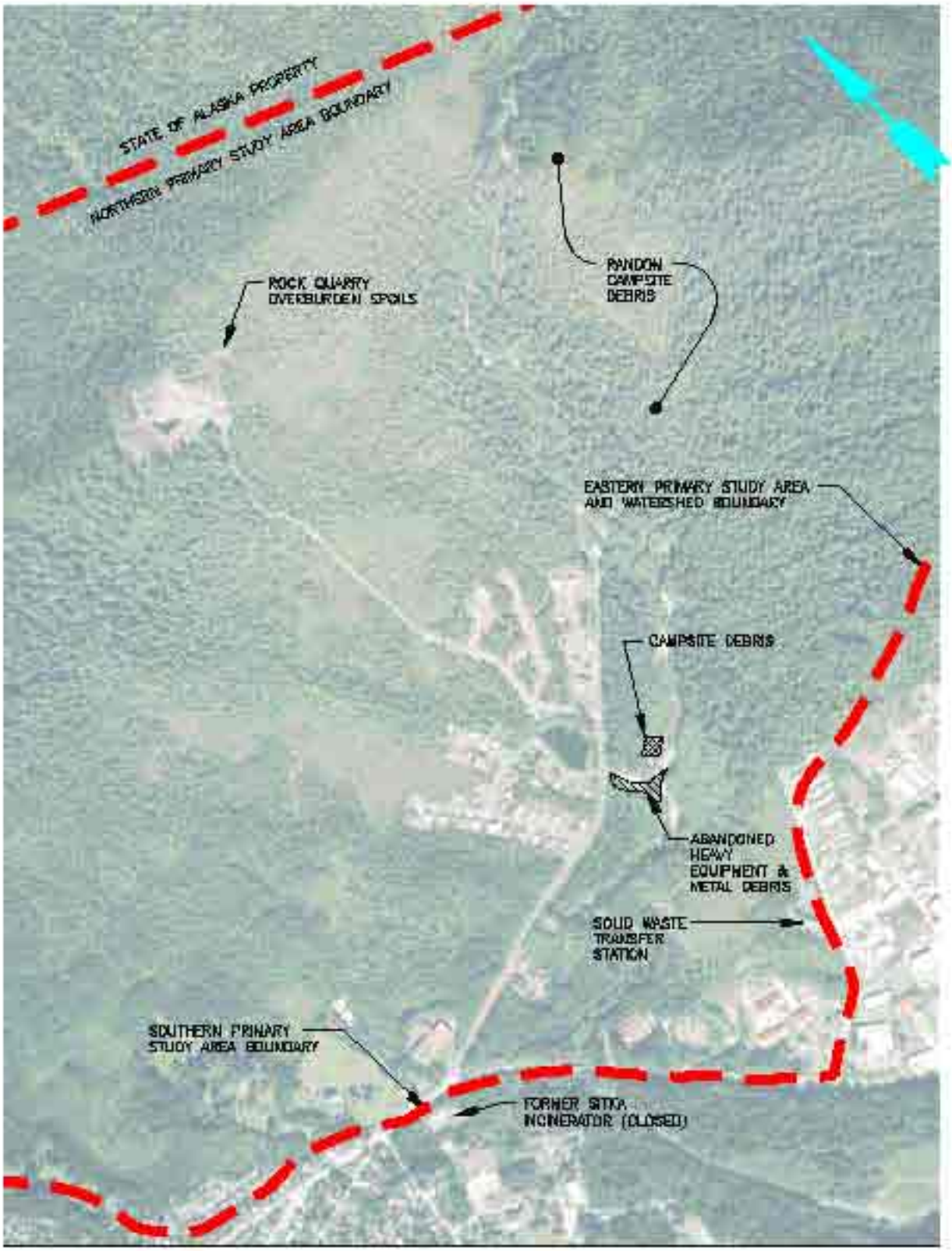
Campsite Debris

During the summer of 2003, the STA discovered a substantial quantity of trash and debris in illegal campsites located in the watershed. This area has significant cultural and historical value to the STA, and they organized a cleanup of the campsites. The photos taken by the STA on this page document the large amount of trash left behind, and the cleanup effort required to return the area to its natural state. In addition to the unsightly mess, uncontrolled and untreated human waste can contribute to the degradation of the water quality, a serious concern in the watershed, since it also serves as a water supply for Sitka.

One additional campsite was also noted between Indian River Road and Indian River, near the Pond on CBS property. This campsite has more permanent structures such as the "tree house" shown on this page. Although not particularly damaging from an environmental standpoint, this does point out the multiple uses that the watershed has. In order to better manage the watershed, unorganized activities such as those represented by this site may need to be more closely monitored.

Rock Quarry Overburden Debris

The remaining solid waste site is the spoil area used for overburden disposal next to the rock quarry. As the quarry expands and rock is extracted, the organic debris must be moved in order to remove the rock. The existing disposal site is located immediately adjacent to the rock quarry, near the northern boundary of SJC property. This site is also adjacent to the site proposed for the land clearing landfill, and is operating under all required permits from CBS and the State of Alaska. The overburden site is shown in the center middle distance of the photo. The total disposal site is less than 0.1 acres in size.



LEGEND

CAMPSITE DEBRIS:
RUBBISH, BUILDING MATERIALS AND CAMPING DEBRIS

HEAVY EQUIPMENT AND METAL DEBRIS:
ABANDONED/JUNKED EQUIPMENT AND MATERIAL

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CITY AND BOROUGH OF SITKA, ALASKA

SOLID WASTE SITES

FIG 10

Chapter 8: Current Permits and Planning Documents

This chapter of the Inventory deals with existing permits, master plans, regional plans, and other planning documents that are being used or are in effect for the Indian River Watershed.

Development Permits
A number of permits for operation and/or future development within the Indian River Watershed were researched. They are summarized as follows:

USACE Permit 4-900230 (Silver Bay 21)
This permit was issued to Sheldon Jackson College in 1993. Issued concurrently with this permit was a Section 401 Clean Water Act Certificate of Reasonable Assurance from the State of Alaska Department of Environmental Conservation, a Coastal Zone Management Program Conclusive Consistency Determination issued by the State of Alaska Division of Governmental Coordination, a Fish Habitat permit issued by the Alaska Department of Fish and Game, and clearance from the State Historical Preservation Office.

This was the principal permit issued to SJC for the development of what are now the subdivisions in the Indian River Watershed. The permit was issued for the development of the SJC property north of Sawmill Creek Road, and encompassed the development of 159 one-acre lots and 42 one-third acre lots. The Permit had an original expiration date of May 31, 1996. The Permit was subsequently extended to May 31, 1999. The USACE has not renewed this permit and considers it to have expired, and requires that any new development obtain a new permit.

USACE Nationwide Permit #18 concurrence, Sitka National Historical Park
The NPS proposed to improve a small parking area within the National Park. They applied for and received permission from the USACE to construct the parking lot improvements in accordance with the NWP #18 (Minor Discharges) conditions.

Storm Water Pollution Prevention Plan (SWPP), File No. MSGP 2000-117 Conditional Approval, issued by the Alaska Department of Environmental Conservation to Tisher Construction.

This permit was issued to Tisher Construction in February of 2003 for the continued operation of the Rock Quarry on property leased from SJC. Subsequent to that permit, A Notice of Intent to discharge storm water was filed by SJC and Tisher Construction and authorized by the Environmental Protection Agency, AKR05A602.

Conditional Use Permit (CUP), City and Borough of Sitka, 1995.
This CUP permitted the operation of the SJC quarry by Winnop's Excavation pending rezoning of the quarry property. The CBS Assembly also approved Ordinance 95-1319, rezoning 18.8 acres from R-2 to Industrial Zoning, which permits the operation of a rock quarry with Conditional Use Permit.

Planning Documents
It is important that the Indian River Watershed Master Plan be consistent with other existing planning documents. Toward this end, a review of existing and draft planning documents pertaining to the Indian River Watershed was done. These documents include the following:

- City and Borough of Sitka Coastal Management Program
- City and Borough of Sitka, Alaska Draft Comprehensive Plan
- Alaska Department of Natural Resources Northern Southeast Area Plan
- Tongass National Forest Land and Resource Management Plan
- Sitka Non-Motorized Transportation Plan
- Sitka Trail Plan 2003
- US National Park Service, General Management Plan, Sitka National Historical Park.

All of these documents were reviewed, but few focus exclusively on the Indian River Watershed. The planning documents expected to have a distinct impact on development within the watershed include the *Northern Southeast Area Plan*, the *Sitka Non-Motorized Transportation Plan* and *The Sitka Trail Plan.*

City and Borough of Sitka, Alaska Comprehensive Plan
The *City and Borough of Sitka, Alaska Draft Comprehensive Plan* was completed in 1999, and will be revised in 2004. The Plan includes a review of existing conditions and presentation of Borough-wide and area-specific goals and objectives. Where found inconsistent with other plans, the Comprehensive Plan is intended to take precedence and the Borough will work toward amending the inconsistency identified in the other plan(s). Goals and plans that may have impacts to planning in the Indian River Watershed include:

Access
- Maintain public access to recreational areas wherever feasible;
- Support inter-agency cooperation to provide the public with additional river access and recreational access.

Land Use
- Require that infrastructure costs be borne by the developers/users;
- Require the submittal and approval of a master development plan before staged development on large parcels;
- Facilitate the availability of adequate land zoned for residential, commercial, industrial and waterfront development;
- Support development that includes greenbelts and parks.

City and Borough of Sitka Coastal Management Program

The City and Borough of Sitka began participating in the Alaska Coastal Management Program in 1979. The *City and Borough of Sitka Coastal Management Program* was completed in 1981, and a significant amendment to the program was approved in 1989. The Program seeks to provide guidance in the management of coastal resources for the long-term benefit of citizens. The boundaries of the Sitka Coastal Management District Program are the boundaries of the City and Borough of Sitka located within the coastal zone (72% of all CBS land).

The Program outlines appropriate use of coastal areas related to topics such as development, energy facilities, transportation and utilities, air, land and water quality, and historical resources. The Program works in cooperation with the State of Alaska Department of Natural Resources Office of Project Management and Permitting's Consistency Review process that requires that projects undertaken within a coastal zone undergo an evaluation to confirm that the project is compatible with statewide and local long-term development policies. The Alaska Coastal Management Program is undergoing major revisions, including redefinition of the Coastal Zone. Therefore the new Consistency Review process could substantially change.

Specific impacts of the current Sitka Coastal Management Program within the Indian River Watershed include restricting development within 25 feet of the 100-year flood high water mark of Indian River.

Alaska Department of Natural Resources Northern Southeast Area Plan

The Northern Southeast Area Plan sets out goals and objectives for management of state lands, including Baranof Island, and specifically the state land within the Tongass National Forest in the Indian River Watershed. State land within the watershed is classified as "Pr – Public Facilities – Retain" and "Ru – Public Recreation and Tourism – Undeveloped." The goals and objectives for the state lands within the Indian River Watershed are:

- *Ownership* - The state land is to be retained in state ownership.
- *Land Use Management* - To be managed to protect and maintain its public recreational and watershed values.
- *Development* - Limited to structures related to public recreation or a water supply system. Easements and rights-of-ways are considered appropriate.

Tongass National Forest Land and Resource Management Plan

In 1997 the U.S. Forest Service developed the Tongass National Forest Land and Resource Management Plan. It designated the upper Indian River Watershed as an *Enacted Municipal Watershed.* The intent of this designation is to manage the land primarily as a municipal water supply, limiting development to that which will not impact water quality and flow.

The management prescriptions for lands designated as Municipal Watershed are:

- *Goals:* To maintain these watersheds as municipal drinking water supply reserves in a manner that meets the State of Alaska Drinking Water Regulations and Water Quality Standards for water supply.
- *Objectives*: Limit most management activities to the protection and maintenance of natural resources. Fish habitat enhancements, and watershed and wildlife habitat improvements, may occur if they are compatible with the municipality's watershed management objectives. Classify forested lands as unsuitable for timber production. Salvage logging will only occur after consultation with the municipality. Recreation uses will be authorized by the Forest Service officer with delegated authority in consultation with the municipality and will be limited to those that will protect water quality and flow.
- *Desired Condition*: Lands managed as Municipal Watersheds are generally in a natural condition. Facilities or structures to provide municipal water supplies may be present. Uses or activities that could adversely affect water quality or supply do not occur. These watersheds provide municipal water that meets all State Drinking Water Regulations and Water Quality Standards for water supply.

Sitka Non-Motorized Transportation Plan

The *Sitka Non-motorized Transportation Plan* started out in 1993 as the *Sitka Preliminary Bicycle Plan.* The goal of the plan was to provide better and safer bicycle facilities, reduce conflicts between bicyclists and other modes of travel, to remove physical barriers and meet ADA accessibility standards, and to provide a more viable alternative to motorized transportation. CBS initiated the *Sitka Non-Motorized Transportation Plan* in early 2002, which served as the successor to the Bicycle Plan.

The *Sitka Non-Motorized Transportation Plan* has the stated goals of Development, Education, Safety, Funding, Maintenance, and Implementation of a non-motorized transportation system in Sitka. It specifically makes recommendations for enhancing existing facilities, and installation of new ones to create an area-wide system of trails throughout the Sitka vicinity. Specifically, the recommendations that impact the Indian River Watershed include:

- Realignment of the Sitka Cross Trail to provide easier and better access.
- Improvements to the Indian River Trail, including a multi-use pathway, and trailhead improvements and upgrades.
- Construction of a non-motorized underpass beneath the Indian River bridge on Sawmill Creek Road.
- Construction of a bridge and the extension of the Sitka Cross Trail across Indian River to connect with the existing Thimbleberry Lake Trail.

Sitka Trail Plan 2003

The *Sitka Trail Plan* is a cooperative effort between Sitka Trail Works, Inc., the City and Borough of Sitka, the USDA Forest Service, the ADNR, the Sitka Tribe of Alaska, and the USDI National Park Service. The Plan's primary stated goal is to set "a clear

direction for managing, maintaining and promoting Sitka trails." Specifically, the improvements targeted in the Indian River Watershed are very similar to the Sitka Non-Motorized Transportation goals, primarily the extension of the Sitka Cross-Trail across Indian River to Thimbleberry Lake.

US National Park Service, General Management Plan, Sitka National Historical Park.
This plan is specific for the Sitka National Historical Park, and as such it has little or no impact on the Indian River Watershed within the Primary Study Area.

Planning and Zoning
The City and Borough of Sitka has adopted Title 21 – Subdivision Code, and Title 22 – Zoning Code as part of its Code of Ordinances.

Subdivision Code – Title 21
The Subdivision Code establishes requirements for the orderly development of new property in Sitka. Any proposed subdivision in the Indian River Watershed will be required to submit preliminary subdivision plats for approval.
The regulations provide for utility and access easements, pedestrian and vehicular traffic control, recreation, common spaces, survey and other elements of land and property development that are consistent with local regulations, comprehensive plans and zoning requirements. The subdivision ordinances apply to all public and private property within the Borough, including state and federal property, subject to some exceptions. It is the responsibility of the developer to submit plans for review and approval by the Planning Commission before a plat for a new subdivision can be approved. The Planning Commission can impose use restrictions on subdivisions within limits connected to topography, road access or other pertinent factors. The final plat must be approved by the Planning Commission for minor subdivisions and by the Planning Commission and Assembly for major subdivisions. Additional information on the Subdivision Ordinances can be found at the City and Borough of Sitka web page, http://www.cityofsitka.com/dept/Planningoffice/Subcode.pdf.

Zoning Code – Title 22
The zoning ordinances also provide for the controlled development of land areas within Sitka, seeking to keep development consistent within areas and regions defined by the zoning maps. The zoning regulations define the types of development that can be constructed within each zone, and designate which zoning regulations apply to specifically zoned areas within the borough. Each zone has permitted uses, those uses which are consistent for the type of development within the zone, and conditional uses, those uses which can be permitted within the zone under certain conditions, for which a conditional use permit is required. Most of the undeveloped areas within the Primary Study Area of the Indian River Watershed are zoned as R-2 MHP or P, with smaller areas zoned as C-1 and I. Table 5, page 81, summarizes the types of zoning and the generally permitted uses for these designations.

Table 5 - Zoning Within the Indian River Primary Study Area

Zoning Code	Type of Zoning	Principal Land Uses
P	Public Lands	Public recreation and educational or institutional uses
C-1	General Commercial	Developed areas involving personal services, convenience goods, and automobile related services.
R-2 MHP	Multi Family and Mobile Home	Urban development for single family and multi family residences and mobile home parks.
I	Industrial	Industrial and heavy commercial uses.

The above table only indicates the overall general uses permitted within these zoning designations. Other specific general and permitted uses for these zones and additional information on the Zoning Ordinances can be found at the City and Borough of Sitka web page, http://www.cityofsitka.com/dept/Planningoffice/Zonecode.pdf.

Chapter 9: Proposed and Potential Development

An important element of the Master Plan Inventory is the documentation of future development plans within the watershed. The planning horizon for this master Plan is 20 years, and any development plans that might be implemented within that horizon were investigated. Reviews of land status maps and interviews with public and private landowners within the watershed were conducted. Based on this information the land within the watershed was placed into one of 5 categories: Currently Developed, Proposed Development, Potential Development, No Development Planned, and Restricted Development. Table 6, page 87, summarizes the development within the Indian River watershed based on these categories. Figure 11A, page 89, shows the various types of development for the areas outside of the Primary Study Area and includes the development summary table. The proposed and potential development in the Primary Study Area is included at larger scale on Figure 11B, page 91. The following paragraphs describe the various development categories.

Currently Developed – 189 acres
These are areas that have already reached a significant level of development, and include the residential subdivisions, roads, the rock quarry, and educational, recreational and institutional development including Sheldon Jackson College, the Alaska Raptor Center, trails, and CBS facilities. Although not all of the land within this category has necessarily reached maximum development, most of the remaining land within these areas will amount to a statistically minor amount of land within the watershed.

Proposed Development – 36 acres
Proposed development is defined in this section as development that has proceeded at least to the initial planning stages. Permits may or may not have been applied for, funding may or may not be available, and plans may or may not have been developed. These are projects that are in the process of being implemented or planned. It should be noted that to the best of our knowledge, no permits for construction have yet been issued for any planned or potential project.

There are six projects that are proposed for development at this time in the Primary Study Area. The project and scope of development is described in the following paragraphs. They are not listed in any particular order, and no significance should be given to the order in which they are presented.

Landclearing Landfill

A landclearing landfill has been proposed by CBS as a way to permit development of much needed residential and commercial space elsewhere in Sitka. The unsuitable overburden soils and vegetation that occur on otherwise developable property must be removed before foundations can be installed and construction can begin. The current landclearing landfill near Granite Creek is rapidly filling up, and when it is full, development of most types of residential and commercial property may come to a halt unless a suitable site can be found for overburden disposal.

This landclearing landfill will be designated as a disposal site of organic topsoil and inorganic unsuitable soils only. No other debris or solid waste of any type will be permitted to be disposed of at this site. The primary proponents of the landfill development project are CBS and Tisher Construction, the operator of the adjacent rock quarry. The land is currently leased by Tisher Construction from SJC, and the project presumably won't move forward without support from SJC. The estimated project area is approximately 18.5 acres. If the landclearing landfill proposed development moves forward, it is likely that the current road access through the quarry will require a significant upgrade. Both the nature of the upgrades and the location of the access road should be carefully evaluated to minimize adverse impacts to the watershed that can occur from road development.

Public Safety Academy Driver Training Course

The current driver training course on the old concrete landing strip on Japonski Island is not suitable for thoroughly developing driving skills in troopers attending the Academy. In addition, Mt. Edgecumbe High School and the University of Alaska Sitka are concerned over pedestrian safety in this area, and would like to develop a more structured approach to their campuses. Any modifications or reductions in the driving area will render the course virtually unusable for driver training as required by the Troopers. The Academy is, therefore, exploring building a new course

on Public Safety Academy land. Some funding for preliminary planning may be available soon. The total development is estimated to occupy approximately 8.8 acres.

Sitka Counseling and Prevention Services (SCPS) Housing and Parking Improvements

SCPS has begun preliminary development of additional 12 to 15 parking spaces at Max's Place Treatment Center on Indian River Road, on property leased from SJC and CBS. That project has been temporarily suspended until permit issues can be worked out. In addition, SCPS is planning on constructing up to three eight-plexes on Flume Circle. This project is in the initial stages of design, and funding is not yet in place for the entire project. Expansion of their existing treatment facility is also under consideration and preliminary planning. Total project development will be about 2.75 acres.

Sitka Cross Trail Realignment and Indian River Trail Head Improvements

The Cross Trail improvements are in the Sitka Non-Motorized Transportation Plan, and are among the highest priorities in the Plan. Improvements would include a realignment of the Cross Trail east of Indian River to permit easier access, the construction of a bridge across Indian River to extend the Cross Trail to Thimbleberry Lake, resurfacing of the trail, construction of an underpass beneath the Sawmill Creek Road bridge over Indian River, and parking and access improvements to the Indian River Trail Head. Of lower priority is a proposal for an addition to the Indian River Trail along Indian River Road and improvements to the Sheldon Jackson College Flume Trail. These proposed routes have not been verified or cleared with landowners nor have funding sources been identified for design or construction.

69KV Electrical Intertie, CBS Electrical Department

With the potential extension of the Sitka Cross Trail across Indian River, the CBS Electrical Department would like to examine the feasibility of extending their 69KV distribution along the same route in the trail easement. The line would be buried approximately 5 feet below the trail surface, within the trail prism. The line is safe and has no significant external electrical or magnetic fields. This project is very preliminary at this time, but it is desirable from the CBS Electrical Department viewpoint as a way of enhancing and protecting the existing electrical distribution system in Sitka.

CBS Residential Subdivision

The City and Borough of Sitka is currently in the preliminary planning stages for a small subdivision on the east side of Indian River Road, opposite Ashaak Subdivision, on the CBS property between Indian River Road and Indian River. The subdivision will be approximately 2 acres in size. It is not known at his time how many lots will ultimately be developed.

Sheldon Jackson College

Much of the remaining undeveloped property within the Indian River watershed that could potentially be developed is owned by SJC. Alpine Partners of Anchorage is currently in discussion with SCJ regarding acquisition of a parcel at the end of Andrew Hope Street to develop a low-income housing. Specific development plans are not available at this time, but some level of planning is now being considered.

Potential Development – 189 acres

The primary difference between proposed development and potential development is that the property owners have stated that they have no plans for development at this time. However, the land that they control may be suitable for future development. SJC is mandated to manage its property for the maximum benefit of its constituents. At some point, development is liable to occur, and it may likely be driven by the costs of development versus the potential return on the investment. CBS also has substantial land which could potentially be developed.

Both of the areas shown for potential development on Figure 11B, page 91, are undeveloped at this time. In the case of the SJC property west of Indian River, the area was originally slated for residential development. Up to 159 one-acre lots and 42 one-third acre lots were originally planned, and about 60 have been constructed so far. It is not unreasonable to expect that the same level of development may eventually be considered.

CBS has no specific plans for development of its property on the east side of Indian River, and the ultimate development plans are a matter of speculation at this time. However, the terrain is relatively flat, and is potentially suitable for residential or commercial development. If developed to the same residential density as the SJC/BIHA subdivisions, there could be room for 10 to 20 residences in this area.

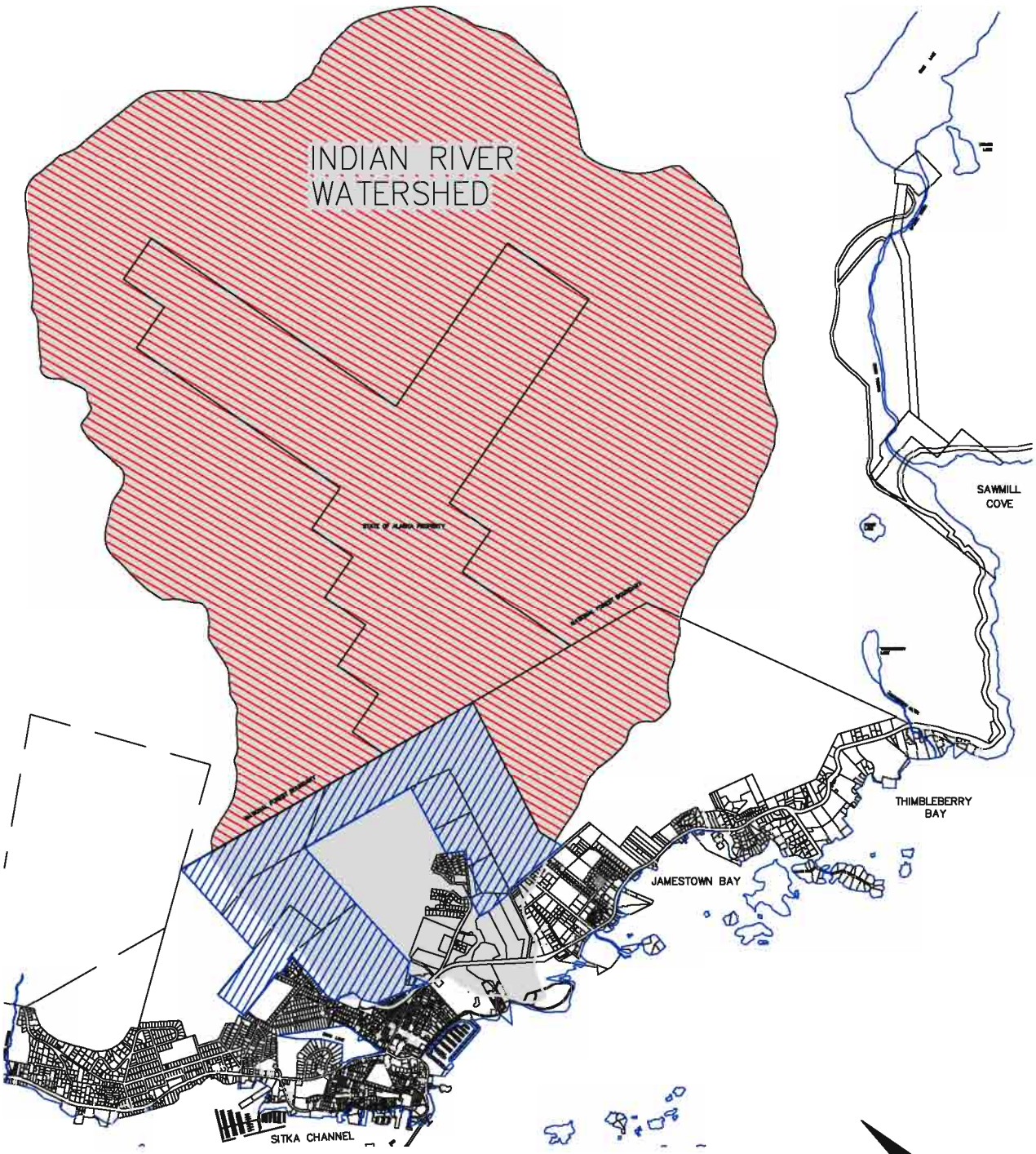
Restricted Development – 6,913 acres
Restricted development is that development which is restricted by the underlying land use requirements. Specifically, State of Alaska land within the Tongass National Forest was selected specifically as a municipal watershed, and devolvement is restricted to minor recreational trails and improvements. No significant development may take place that would change the water quality or hydrology of the watershed. Likewise, the U. S. Forest Service is required to manage the upper Indian River Watershed as a Municipal Watershed in the 1997 Tongass National Forest Land and Resource Management Plan. The vast majority (87%) of the land within the Indian River watershed falls into this category.

No Development Planned – 573 acres
In this category are lands owned by public agencies within the watershed and outside of the Tongass National Forest boundary. Parcels include tracts owned by the U.S Forest Service, the City and Borough of Sitka, the U.S. Geophysical Survey and the Alaska Mental Health Trust. Land managers for these properties were contacted and plans for future development were discussed. None of the parcels identified, with the exceptions already noted under Proposed or Potential development, have any identifiable development plans within the 20-year planning horizon of this Master Plan.

Summary
In all cases, development will be contingent on a number of factors, including permitting issues, constructability, utility infrastructure cost and community support. The purpose of this Master Plan is to provide a good background and understanding of the issues facing development in the Indian River Watershed ahead of project planning.

Table 6 – Development Summary

Development Classification	Area (Acres)	% of Watershed
Currently Developed	189	2.4%
Proposed Development	36	0.5%
Potential Development	189	2.4%
Restricted Development	6,913	87.4%
No Development Planned	573	7.3%
Totals	7,900	100%



INDIAN RIVER WATERSHED			
CURRENTLY DEVELOPED		189 ACRES	2.4%
PROPOSED DEVELOPMENT		36 ACRES	0.5%
POTENTIAL DEVELOPMENT		189 ACRES	2.4%
TOTAL DEVELOPABLE AREA		414 ACRES	5.3%
NO DEVELOPMENT PLANNED		573 ACRES	7.3%
RESTRICTED DEVELOPMENT *		6913 ACRES	87.4%
TOTAL ACREAGE		7900 ACRES	100%

*DEVELOPMENT LIMITED TO MINOR RECREATION IMPROVEMENTS CONSISTENT WITH MUNICIPAL WATERSHED MANAGEMENT RESTRICTIONS.

NOTE: REFERENCE FIGURE 11B FOR PROPOSED AND POTENTIAL DEVELOPMENT AREA DETAILS

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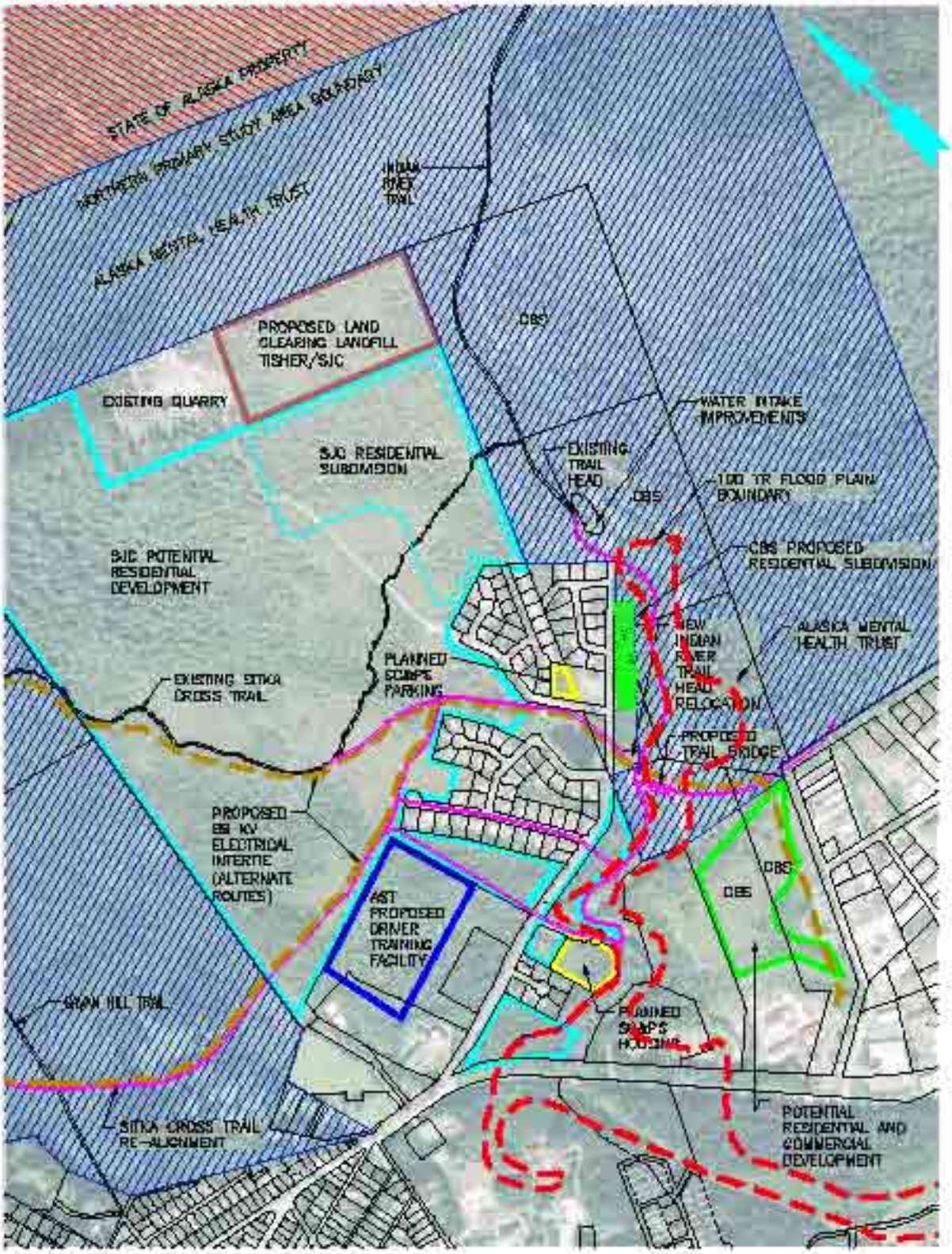
WATERSHED DEVELOPMENT SUMMARY

FIG 11A



PROPOSED DEVELOPMENT

- LANDCLEARING LAND FILL, 18.5 ACRES
- TROOPER DRIVER TRAINING FACILITY, 11.0 ACRES
- SCAPS PARKING, 0.7 ACRES
- SCAPS HOUSING, 2.1 ACRES
- SITKA CROSS TRAIL REALIGNMENT & TRAIL HEAD, 1.5 ACRES
- 69KV ELECTRICAL INTERTIE LINE
- CBS RESIDENTIAL SUBDIVISION, 3.0 ACRES

POTENTIAL DEVELOPMENT

- SJC RESIDENTIAL HOUSING, 180 ACRES
- CBS RESIDENTIAL/COMMERCIAL, 9 ACRES

OTHER

- NO DEVELOPMENT PLANNED
- MUNICIPAL WATERSHED MANAGEMENT ONLY
- 100 YR FLOOD BOUNDARY

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PROPOSED AND POTENTIAL DEVELOPMENT WITH FLOOD PLAIN BOUNDARY

FIG 11B

Chapter 10: Fish Habitat

Many species of fish and terrestrial wildlife make their home in Indian River. Land mammals include deer, bear, marten, mink, squirrel and goat. Birds include eagles and other raptors, mergansers, a variety of ducks, songbirds and others. Due to budget and time constrains, the Indian River Master Plan habitat inventory has been limited primarily to fish habitat. Human development has affected and will continue to affect other animal species and habitat, but a detailed analysis of this impact is beyond the scope of this current planning effort.

Fish Habitat Summary

A fish habitat survey was conducted on November 18-20, 2003 to assess condition and availability of fish habitat in the Indian River. USDA channel types were assigned to different reaches so that Best Management Practices could be utilized for habitat protection. A total of seven Reaches were identified and an overview of the Reaches is shown in Figure 12, page 95. Habitat inventory mapping was performed for Reaches 1-5 by ground survey totaling 22 hours. Habitat for Reaches 1-3 are shown in Figure 12A, page 97. Habitat for Reach 4 is shown in Figure 12B, page 99. Habitat for Reach 5 is shown in Figure 12C, page 101. Detailed habitat mapping was not performed for Reaches 6 and 7 which are above the confluence of the east and west forks of the river and are outside of the Primary Study Area.

Coho salmon, pink salmon, chum salmon, steelhead trout, Dolly Varden char, resident rainbow, and cutthroat trout utilize Reaches 1-5 and the lower portions of Reaches 6 and 7 for passage, spawning, incubation, and rearing. The times at which they utilize these Reaches are identified in Table 7, page 106. Yearly (1962-2003) pink salmon peak escapement counts conducted by ADF&G are provided in Table 8, page 107. Escapement to the river is strongly influenced by straying of fish from the Sheldon Jackson Hatchery.

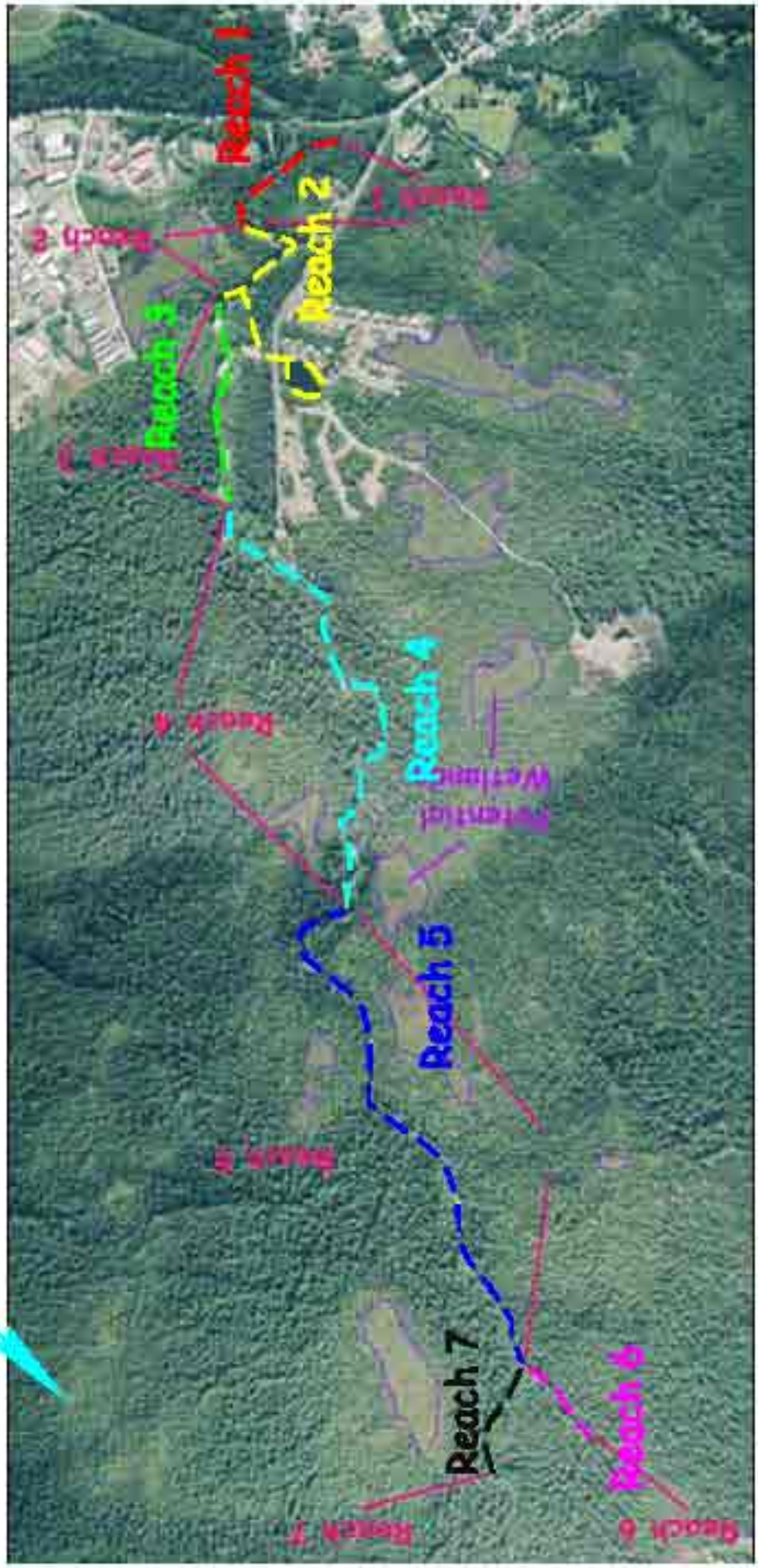
Suitable spawning habitat for salmon present in the river typically consists of 2-4 inch gravel with sufficient depth and flow of water to provide oxygen to developing embryos. Suitable salmon spawning habitat is present up to the lower portions of Reaches 6 and 7. The largest uniform area of preferred spawning habitat for coho salmon and steelhead was located from 500m to 1000m upstream from Sawmill Creek Road Bridge (Reach 3 in Fig 12A). Spawning habitat is sensitive to the deposition of fine sediment. Any development near the stream or its tributaries should include erosion control measures to minimize potential sediment sources (Forest Service Handbook 2509.22, available on line at http://www.fs.fed.us/r10/ro/policy-reports/bmp/index.shtml, best management practices (BMP) 13.11-13, 14.9, 14.11, 14.13) stream bank protection (BMPs 13.16, 14.17) and control of in-channel operations (BMP 14.14). Braided channel areas should be avoided for stream crossings (BMP 14.2).

Desirable rearing habitat contains instream cover to provide physical shelter from high velocities and a visual barrier from predators. Large woody debris (LWD) is particularly

important in forming pools with cover and can help trap substrate suitable for spawning. Juvenile coho are frequently found to be strongly associated with LWD. Reaches 4, 6 and 7 have the highest concentrations of LWD and likely depend on it for pool formation and bank stability. The Tongass Timber Reform Act passed in 1990 mandated a minimum buffer zone of 100 ft (33m) on all Class I streams (those containing anadromous fish). Best Management Practices 12.6 describes how the riparian zone may best be managed to ensure continuous input of LWD over time and maintain habitat capability in these reaches. Buffer zones should extend along tributaries utilized by both anadromous and resident fish.

Reach 2 and Reach 5 are less influenced by LWD and stream banks are relatively stable due to bedrock; however, steep banks are susceptible to erosion if disturbed by road cuts or timber harvest. Riparian management in these areas should emphasize protection of unstable side-slopes. Stream crossings are generally not practical in these channels and road construction should emphasize the maintenance of channel side-slope stability (BMPs 14.2, 14.3, 14.7, 14.8). Lack of LWD in Reach 2 may be due to logging and development on adjacent banks that has reduced recruitment of LWD to the stream.

There is some concern for providing fish access through culverts in narrower reaches and tributaries. Moderate gradients can make it difficult to maintain fish passage through culverts. BMP 14.17 describes correct installation of culverts such that they do not restrict fish passage or create bed scour or velocity barriers.



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FISH HABITAT INVENTORY

FIG 12

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REACH 1-3 FISH HABITAT INVENTORY

FIG 12A

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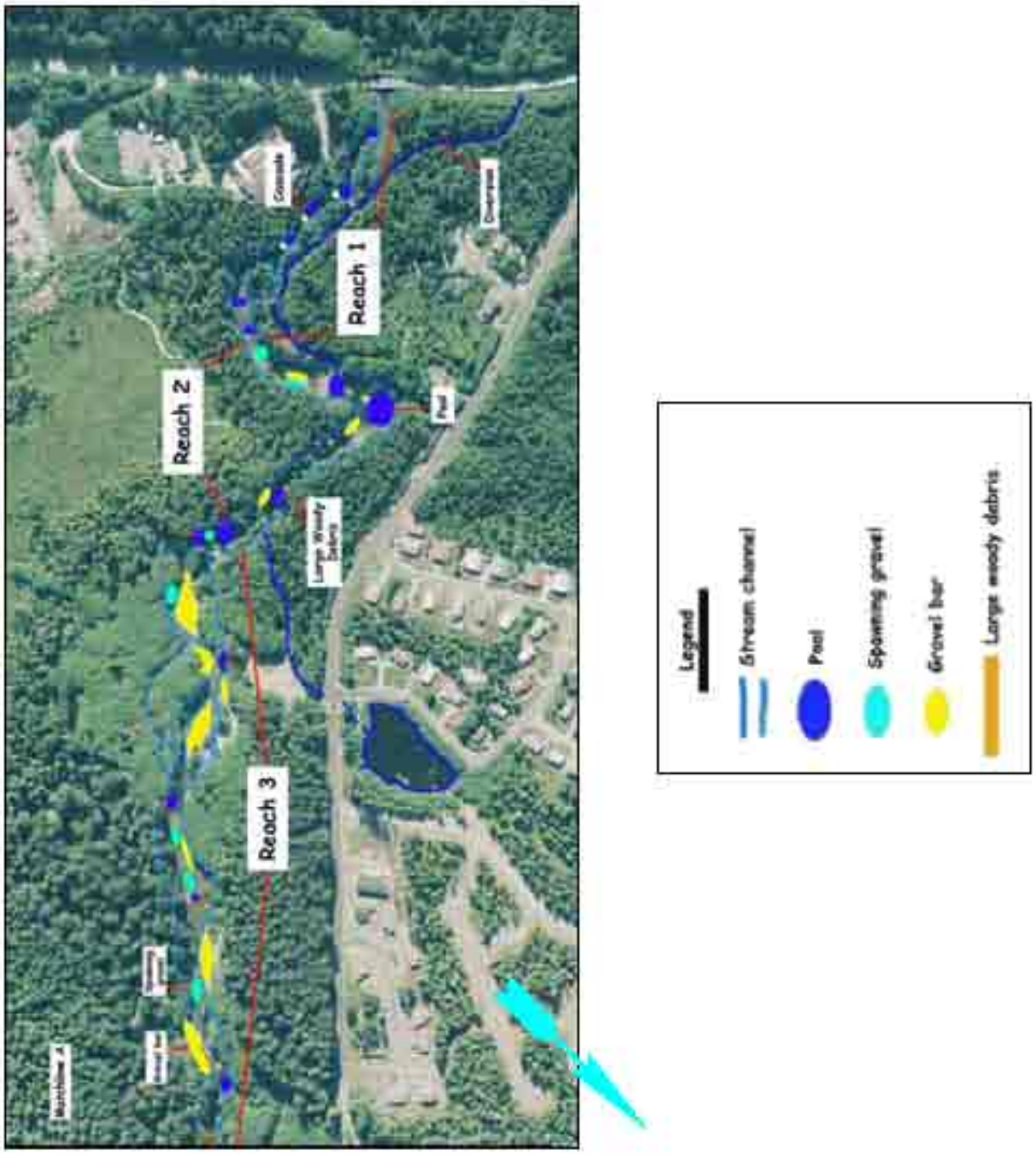
REACH 4 FISH HABITAT INVENTORY

FIG 12B



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REACH 3 FISH HABITAT INVENTORY

FIG 12C

Fish Habitat Assessment Technical Memorandum

Introduction

The Indian River supports several anadromous fish species including pink salmon (Onocorhynchus gorbuscha), chum salmon (O. keta) and coho salmon (O. kisutch), steelhead trout (Salmo gairdneri) and Dolly Varden char (Salvalinus malma). Non-anadromous resident fish include rainbow trout (Salmo gairdneri), coast-range sculpin (Cottus aleuticus) and resident Dolly Varden that do not migrate to sea (Nadeau & Lyons 1987). Cutthroat trout (O. clarki) and Chinook salmon (O. tshawytscha) have also been reported in the river (Williams 2001) although the latter are likely strays from the Sheldon Jackson Hatchery.

This report is an assessment of fish habitat in the Indian River upstream of Sawmill Creek Road Bridge. The reach downstream of the bridge has already been well documented (Paustian & Hardy 1995). The aim of the fish habitat assessment is to identify the key habitat areas that are essential in maintaining healthy fish populations and could be at risk from degradation by proposed developments. This will allow measures to be taken to help protect key areas during development.

Objectives

1. Assess the condition and availability of fish habitat in the Indian River upstream of Sawmill Creek Road Bridge.
2. Identify keys areas of spawning and rearing habitat needed to sustain indigenous fish populations.
3. Make recommendations for protecting fish habitat during development activities.

Methods

Habitat Condition and Availability

A habitat survey was conducted on November 18 to 20, 2003, beginning at the Sawmill Creek Road Bridge and extending 3600m upstream to where the river branches into two forks. Both the east and west forks were then surveyed for a further 1300m. A total of 22 hours were spent on the ground conducting the habitat survey. The reaches within the Primary Study Area were covered four times (two roundtrips) by the stream surveyor operating a metric hip chain and recording features at measured distances along the river. A handheld GPS device was used to mark waypoints of major features to help locate them on the aerial photograph. Stream habitat was categorized as pool, glide, riffle or cascade following the classifications of Bisson et al (1981). Pools are defined as having slow water flow and are deeper than the average depth of the reach. Riffles are relatively shallow with fast water velocity. Glides have uniform depth, moderate water velocity and smooth water surface. Cascades or falls have fast, turbulent water flow and steep gradient associated with bedrock steps. The length and width of each habitat unit was measured in meters using the hip chain and a Leica laser rangefinder. The dominant substrate size on the stream bed and the number of pieces of large wood in the stream was also recorded. Large woody debris (LWD), defined as woody material greater than 4 inches in diameter and 10 ft in length, is critical in providing habitat diversity and maintaining stream

channel structure. Data collected during the survey are summarized in Table 10, page 114 and Table 11, page 114.

The river was divided into reaches according to USDA channel type classification, which defines a stream channel based on physical attributes such as gradient, substrate, stream bank incision and channel containment. The USDA Forest Service Best Management Practices for protecting fish habitat utilize these channel types (USDA 1992, 1996).

Fish Species Presence
Fish species present at the time of the survey was investigated under ADFG permit SF-2003-143 by setting 6 minnow traps baited with cured salmon eggs in an area of high quality rearing habitat. Captured fish were anesthetized in a solution of tricaine methanesulfonate (MS-222), weighed to the nearest 0.1g, and their total length measured to the nearest 1mm. The fish were then placed in a container of fresh stream water to recover before being returned to the stream.

Results
Reach Descriptions
Table 9, page 113, and Table 10, page 114, summarize the proportions of habitat type present in each reach. Table 13, page 115, compares amounts of LWD among reaches. Table 9 gives some indication of habitat complexity for each reach. A low mean habitat area indicates greater habitat complexity since it results from a greater number of small units. A high mean habitat area resulting from a small number of large units would indicate more uniform habitat. Reaches 1, 4 and 6 exhibit high habitat complexity while Reaches 2 and 5 have more uniform habitat. Table 10 gives estimates of the amount of habitat available for rearing and spawning in each reach and the amount of LWD present per 100m of stream.

Habitat maps for each reach are presented in Figure 12A, 12B, and 12C. These maps are based on sketch maps drawn in the field. GPS waypoints taken in the field helped locate major features on aerial photographs. Reach 1 begins just above Sawmill Creek Road Bridge and passes through a steep-sided bedrock gorge for 265m. The Raptor Center is situated on the east side of the gorge. The channel has a moderate gradient and is characterized by steep riffles and bedrock cascades (Plate 1), but these are not significant barriers to fish migration (Nadeau & Lyons 1987). The USDA channel type chosen for this reach is MC2, moderate width and incision, contained channel, due to the observed gradient and bedrock control of the stream. There is limited pool habitat present (13%) and only two pieces of LWD were recorded. Suitable rearing habitat for fish is limited. Spawning habitat is limited by the lack of suitable spawning gravel, the substrate being dominated by bedrock and boulders.

Reach 2 is 210m long and begins where the stream emerges from the rock gorge and continues over the Sheldon Jackson diversion dam. The diversion dam profoundly alters the character of the channel in Reaches 1 and 2. The dam flattens the stream gradient upstream, creates an extensive backwater, interrupts gravel and LWD transport

downstream and exacerbates scouring of the riverbed downstream. A fish ladder allows access to andromous fish over the dam. The gradient is low and the substrate ranges from sand to 3-inch gravel. Pool habitat constitutes 46% of the habitat due to the large pool area above the dam (Plate 2). Channel type is LC1, low gradient contained channel. There is a little LWD and spawning habitat is limited by small substrate size and low flow. Riparian vegetation consists of second growth spruce and hemlock forest. Reaches 1 and 2 have limited LWD perhaps as a result of the logging and development that has taken place adjacent to these reaches, reducing the recruitment of LWD to the stream from the riparian zone.

Reach 3 (Plate 3) is characterized by extensive gravel bars, among which the channel is often braided. The substrate is dominated by 3-5 inch gravel and provides extensive spawning habitat. The channel type is FP5, wide low gradient flood plain channel. Riparian vegetation is dominated by alder reflecting the more unstable, meandering nature of the channel. This reach is approximately 75% riffle and 25% pool and glide habitat. Reach 3 ends when the channel becomes narrower, 535m upstream of an old log bridge. The remains of old vehicles are present on the west bank just upstream of the log bridge.

The first major log jam in the stream, 1085m from Sawmill Creek Road Bridge, marks the beginning of Reach 4 (Plate 4). The channel type is FP4, low gradient flood plain channel. The channel splits around an island near the municipal intake site then continues to meander through large woody debris piles for 1240m. The dominant substrate is gravel ranging from 1 to 5 inches in diameter. Pools with LWD make up over 35% of the habitat and provide good rearing areas. A large proportion of the riffle habitat is suitable for spawning. A tributary enters the stream in Reach 4 on the west bank 470m upstream from the municipal intake site. There was insufficient time during the stream survey to follow tributaries upstream. Their position in Figure 12 is based on examination of the aerial photograph.

The beginning of Reach 5 is 2325m upstream from Sawmill Creek Road Bridge and is marked by a sharp bend to the east where some bank erosion has occurred (Plate 5). A small tributary enters the stream on the east bank 266m upstream from the USGS stream gauge located in this reach. The stream is more contained and incised in Reach 5 due to the influence of bedrock, and is characterized by long, deep pools and some bedrock cascades (Plate 6). The channel type is LC2, moderate gradient, contained, narrow valley channel. Suitable spawning habitat is limited by the presence of fine clay and bedrock. There is almost as much pool habitat as in Reach 4, but pools are larger and fewer and associated with bedrock rather than LWD. The riparian area on the west bank is dominated by muskeg. The stream splits into two forks at the end of Reach 5, 3600m from the Sawmill Creek Road Bridge (Plate 7).

Reach 6 is the west fork of the river. The channel narrows to an average of 7m wide and meanders among frequent LWD piles (Plate 8). Pools associated with LWD comprise 33% of the habitat. The channel type is FP3, narrow low gradient flood plain channel.

The dominant substrate is fine gravel which is less preferable for spawning. Reach 7 is the east fork of the river and has a large amount of LWD and similar width to the west fork. Gravel bars are more prevalent than in the west fork and gravel size is more suitable for coho spawning (Plate 9). Deep plunge pools associated with LWD dams make up about 35% of the habitat. The channel type is MM1, narrow, mixed control channel. The gradient increases upstream as adjacent hillside slopes become steeper. Four small tributaries enter the stream on the west bank at 300m, 400m, 630m and 1150m upstream from the confluence of Reaches 6 and 7.

Fish Habitat Use

Coho salmon, pink salmon, chum salmon, steelhead trout, Dolly Varden char, resident rainbow, and cutthroat trout utilize reaches 1-5 and the lower portions of Reaches 6 and 7 for passage, spawning, incubation, and rearing (ADFG 2004). The times at which they utilize these Reaches are identified in Table 7 on page 106.

Yearly (1962-2003) pink salmon peak escapement counts by type of survey conducted by ADF&G are provided in Table 8 on page 107. These counts are lower than total escapement but give an indication of run strength and the minimum escapement. Escapement to the river is strongly influenced by straying of fish from the Sheldon Jackson Hatchery (Paustian and Hardy 1995). The high numbers observed in some years (over 200,000) may reflect hatchery returns rather than the numbers the river can support.

Table7 – Species Periodicity

Species Periodicity Chart - Indian River
(Based on professional judgement of ADFG biologists)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Coho Salmon												
Passage									XX	XXXX	XXXX	
Spawning										XXXX	XXXX	
Incubation	XXXX	XXXX	XXXX	XXXX	XX					XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Pink Salmon												
Passage							XX	XXXX	XXXX	X		
Spawning							XX	XXXX	XXXX	X		
Incubation	XXXX	XXXX	XXXX	XXXX	XX		XX	XXXX	XXXX	XXXX	XXXX	XXXX
Rearing			XX	XXXX	XXXX	X						
Chum Salmon												
Passage							XX	XXXX	XXXX	XXX		
Spawning								XXXX	XXXX	XXX		
Incubation	XXXX	XXXX	XXXX	XXXX	XX			XXXX	XXXX	XXXX	XXXX	XXXX
Rearing		XX	XXXX	XXXX	XXXX	XXX						
Steelhead Trout												
Passage				XXX	XXXX							
Passage-Upstr.						XXXX	XX					
Spawning-Dnstr.				XXX	XXXX	XX						
Incubation				XXX	XXXX	XXXX	XXXX	XXXX				
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Dolly Varden												
Spawning									XX	XXXX	XXXX	
Incubation	XXXX	XXXX	XXXX	XXXX	XX				XX	XXXX	XXXX	XXXX
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Rainbow Trout												
Spawning				XXX	XXXX	XX						
Incubation				XXX	XXXX	XXXX	XXXX	XXXX				
Rearing	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Incubation life phase includes period from egg deposition to fry emergence.

The November 2003 habitat survey was conducted towards the end of the salmon run, but a small number of adult coho salmon were observed throughout the stream. Individual coho were observed 4620m and 4800m upstream of the Sawmill Creek Road Bridge in the west fork. In the east fork, salmon eggs were observed exposed in gravel approximately 4400m upstream and a salmon carcass was found at 4650m upstream from Sawmill Creek Road Bridge. Juvenile fish were retrieved from minnow traps after 22 hours soaking in the stream. Stream temperature on retrieval of traps was 3.3^{o}C. Figure 12B on page 99 shows the location of minnow trapping sites. Traps 4 and 5 contained no fish, but the remaining traps contained a total of 7 Dolly Varden and 8 juvenile coho. Lengths, weights and age classes of captured fish are given in Table 11 on page 114.

Table 8. Indian River Peak Escapement Counts by Year and Type.

Year	Species	Peak Count	Survey Type
1962	Pink	500	FOOT
1963	Pink	300	FOOT
1963	Pink	300	FOOT
1964	Pink	300	FOOT
1965	Pink	500	FOOT
1966	Pink	300	FOOT
1967	Pink	150	FOOT
1969	Pink	500	FOOT
1971	Pink	300	FOOT
1972	Pink	200	FOOT
1973	Pink	500	FOOT
1977	Pink	17,500	AERIAL
1978	Pink	2,000	FOOT
1979	Pink	5,991	FOOT
1980	Pink	2,893	FOOT
1981	Pink	16,000	FOOT
1982	Pink	12,000	FOOT
1983	Pink	21,000	AERIAL
1984	Pink	6,000	AERIAL
1985	Pink	11,000	FOOT
1986	Pink	10,000	AERIAL
1987	Pink	3,000	AERIAL
1988	Pink	1,651	FOOT
1990	Pink	1,750	FOOT
1993	Pink	800	FOOT
1994	Pink	55,000	AERIAL
1995	Pink	14,000	AERIAL
1996	Pink	185,000	AERIAL
1997	Pink	260,000	AERIAL
1998	Pink	66,000	FOOT
1999	Pink	160,000	FOOT
2000	Pink	85,000	AERIAL
2001	Pink	90,000	AERIAL
2002	Pink	68,000	AERIAL
2003	Pink	270,000	AERIAL

These are yearly peak count, total escapement would be greater.

Discussion

Suitable spawning habitat for pink, chum and coho salmon and steelhead trout typically consists of 3-4 inch gravel with sufficient depth and flow of water to provide oxygen to developing embryos (Bjorn & Reiser 1991). Dolly Varden prefer smaller gravel of 1-3 inches (Kitano & Shimazaki 1995). Areas suitable for spawning are places that are free from deposits of fine material which are typically found in riffles and the lateral margins and tailout areas of bars and pools.

Pink and chum fry migrate out of the river shortly after hatching, but other salmonids spend part of their growth period rearing in the stream. Coho salmon may remain in the Indian River for three years before migrating to the ocean (Williams 2001) while steelhead can spend up to four years in freshwater (Meehan & Bjorn 1991). Desirable rearing habitat contains instream cover to provide physical shelter from high velocities and a visual barrier from predators. Boulders, deep pools, water turbulence, undercut banks, overhanging riparian vegetation and woody debris may all provide cover to some extent. Large woody debris is particularly important in forming pools with cover and can also help trap substrate suitable for spawning. Juvenile coho are frequently found to be strongly associated with LWD pools, particularly in winter when the need to minimize energy expenditure is greatest (Cunjak 1996). Large woody debris increases habitat complexity which provides more opportunity for intra- and inter-specific fish species segregation and therefore increased diversity. Juvenile salmonids, particularly steelhead, utilize riffle habitat as well as pools.

Pink and chum salmon utilize Reaches 1 to 5 and the lower portions of Reaches 6 and 7 for spawning, particularly in years where returns exceed 200,000 fish. Such large numbers result in pink salmon attempting to spawn throughout the river. Coho utilize gravel for spawning a long way upstream, at least 4800m from Sawmill Creek Road Bridge and also make use of several tributaries on the way (ADFG 2003). The largest uniform area of preferred spawning habitat for coho and steelhead is available in Reach 3.

Large woody debris is most abundant in Reaches 4, 6 and 7 providing abundant rearing habitat there. The LWD and associated pools in Reach 4 provide good high habitat complexity and extensive rearing habitat for juvenile coho, steelhead and Dolly Varden. Several age classes of Dolly Varden and juvenile coho were found in this Reach in November suggesting these species overwinter in the river. The deep bedrock pools of Reach 5 provide cover for resident Dolly Varden, but may be less attractive to juvenile coho fry that prefer LWD.

Recommendations for Habitat Protection

The essential role of LWD in the stream should be maintained by protecting riparian areas. Natural recruitment of LWD into the stream from riparian zones occurs slowly as a result of stream bank erosion and windthrow. Removal of trees from the riparian zone eliminates this source of LWD and adversely impacts fish habitat. Although the majority of LWD (94%) is derived from trees growing within 20m (66ft) of the stream (Martin Environmental 1998), a 20m wide buffer zone is often not wide enough to ensure the

supply of LWD. If trees are cut down to within 20m of the stream, remaining trees tend to fall more quickly due to windthrow. There may be an initial increase in LWD recruitment to the stream, but the future supply of LWD is diminished and fish habitat is eventually degraded.

The Forest Service Handbook 2509.22 states that riparian areas serve to store sediment, contribute to the maintenance of desirable water temperature, stabilize banks and the flood plain as well as contributing LWD to the stream. In Reach 4 (FP4) habitat capability is particularly dependent on the continuous input of LWD over time. Best Management Practice 12.6 in the handbook describes how the riparian zone may best be managed for this channel type. The Indian River is assigned a stream value of Class I owing to the presence of anadromous fish. The Tongass Timber Reform Act (1990) mandated a minimum buffer zone of 100 ft (33m) on all Class I streams and on Class II streams (resident fish present) flowing into a Class I stream. Buffer zones should extend along tributaries as these are likely used by coho for spawning and rearing.

FP4 and FP5 channels (Reaches 3 and 4) are also sensitive to the introduction of fine sediment from upstream. The quality of the extensive spawning habitat of here could be degraded by the deposition of fine material. Care should be taken to minimize impacts to stream banks that could accelerate bank erosion. Removal of vegetation from stream banks should be avoided. The removal of old vehicles and other waste from banks should be a priority. Areas disturbed by cleanup efforts should be revegetated. Any bridge crossings and roads near these reaches should include erosion control measures to minimize potential sediment sources (FSH 2509.22, BMPs 13.11-13, 14.9, 14.11, 14.13) stream bank protection (BMPs 13.16, 14.17) and control of in-channel operations (BMP 14.14). Braided channel areas should be avoided for stream crossings (BMP 14.2). Development of riparian areas where the stream has a tendency to migrate laterally could lead to undesired channelization and hardening of riverbanks. Riparian areas adjacent to unconfined channel types should be protected.

LC1 (Reach 2) and LC2 (Reach 5) channels are less influenced by LWD and stream banks are relatively stable due to bedrock, however, any steep banks present are susceptible to erosion if disturbed by road cuts or timber harvest. Riparian management should emphasize the protection of unstable side-slopes. Stream crossings are generally not practical in these channels and any road construction should emphasize maintenance of channel side-slope stability (BMPs 14.2, 14.3, 14.7, 14.8).

FP3 (Reach 6) channels are significantly influenced by LWD and sediment loading can adversely impact spawning gravels. Stream banks are composed of fine textured alluvium, which due to low stream power, are only moderately sensitive to disturbance (USDA 1992). Riparian management here should emphasize erosion control (BMPs 13.11 to 13.13, 13.16, 14.9 to 14.11). There is some concern for providing fish access through culverts in narrower reaches and tributaries. Culverts should be installed such that they do not restrict fish passage or create bed scour or velocity barriers (BMP 14.17).

MM1 (Reach 7) channels depend on LWD for trapping gravel substrates and pool-formation, and riparian vegetation plays an important role in bank stabilization. The riparian buffer must be well maintained (BMP 13.16). Upstream migration of fish is a major concern when planning for stream crossings in these channels as moderate gradients make it difficult to maintain fish passage through culverts (BMP 14.17). Control of in-channel operations is also important to minimize stream channel disturbances and related sediment production (BMP 14.14).

Conclusions

Coho salmon, pink salmon, chum salmon, steelhead trout, Dolly Varden char, resident rainbow, and cutthroat trout utilize Reaches 1-5 and the lower portions of Reaches 6 and 7 for passage, spawning, incubation, and rearing. The largest uniform area of preferred spawning habitat for coho and steelhead is present in Reach 3. Reaches 4, 6 and 7 have the highest concentrations of LWD and likely depend on it for pool formation and bank stability. Riparian areas should be managed according to Forest Service Best Management Practice available online at http://www.fs.fed.us/r10/ro/policy-reports/. A minimum riparian buffer zone of 100ft is required by the Tongass Timber Reform Act (1990) on anadromous streams. Reaches 3 and 4 are sensitive to bank erosion and spawning habitat could be degraded by the deposition of fine material resulting from bank disturbance. It is recommended that bank disturbance be minimized and any developments should include erosion control and bank protection measures (BMPs Chapter 13). These management practices should also be adopted along Indian River tributaries.

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Table 9: Summary Statistics for Indian River above Sawmill Creek Road Bridge

Stream Reach	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Reach 1 MC2	Number of Units	7	6	0	4	**17**
Length: 265m	Area (m^2)	2016	438		886	**3340**
Width: 9-20m	Mean Area	288	73		222	**196**
	% of Total Area	60.4	13.1		26.5	100
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Reach 2 LC1	Number of Units	5	3	1	0	**9**
Length: 210m	Area (m^2)	1424	1727	570		**3721**
Width: 14-37m	Mean Area	285	576	570		**413**
	% of Total Area	38.3	46.4	15.3		100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Reach 3 FP5	Number of Units	14	11	1	0	**26**
Length: 610m	Area (m^2)	6154	1642	360		**8156**
Width: 8-27m	Mean Area (m^2)	440	149	360		**314**
	% of Total Area	75.5	20.1	4.4		100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Reach 4 FP4	Number of Units	25	21	3	2	**51**
Length: 1241m	Area (m^2)	6093	3872	838	72	**10875**
Width: 7-19m	Mean Area (m^2)	244	184	279	36	**213**
	% of Total Area	56.0	35.6	7.7	0.7	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Reach 5 LC2	Number of Units	18	11	1	1	**31**
Length: 1280m	Area (m^2)	7956	4178	180	280	**12594**
Width: 8-20m	Mean Area (m^2)	442	380	180	280	**406**
	% of Total Area	63.2	33.2	1.4	2.2	100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Reach 6 FP3	Number of Units	27	14	0	0	**41**
Length: 1342m	Area (m^2)	5922	2903			**8825**
Width: 5-12m	**Mean Area (m^2)**	219	207			**215**
	% of Total Area	67.1	32.9			100.0
	Habitat Variable	Riffle	Pool	Glide	Cascade	All Units
Reach 7 MM1	Number of Units					
Length: 1350m	Area (m^2)	Estimate of % area from subsampling				**9000**
Width: 4-14m	**Mean Area (m^2)**					
	% of Total Area	65.0	30.0	0.0	5.0	100.0

Table 10: Habitat Availability for Spawning and Rearing of Coho and Steelhead

% Area Available			
Reach	**Spawning**	**Rearing**	**# Pieces LWD per 100m**
Reach 1 MC2	<1	10	0.75
Reach 2 LC1	5	25	0.95
Reach 3 FP5	50	20	2.8
Reach 4 FP4	25	40	4.9
Reach 5 LC2	10	20	3.2
Reach 6 FP3	5	30	5.1
Reach 7 MM1	10	25	7

Table 11: Lengths and Weights of Fish Trapped in November

Dolly Varden			Coho		
Length (mm)	Weight (g)	Age (yrs)	Length (mm)	Weight (g)	Age (yrs)
175	50.1	4	95	7.3	2
123	16.6	2	90	7.2	2
87	6.6	1	90	7.1	2
87	5.7	1	87	6.1	2
78	4	1	80	4.6	2
78	4.5	1	79	4.8	2
77	5.6	1	73	3.7	1
			65	2.5	0.5

Age is inferred from length data collected by Williams (2001)

Table 12: Percentage Habitat Type of Reach

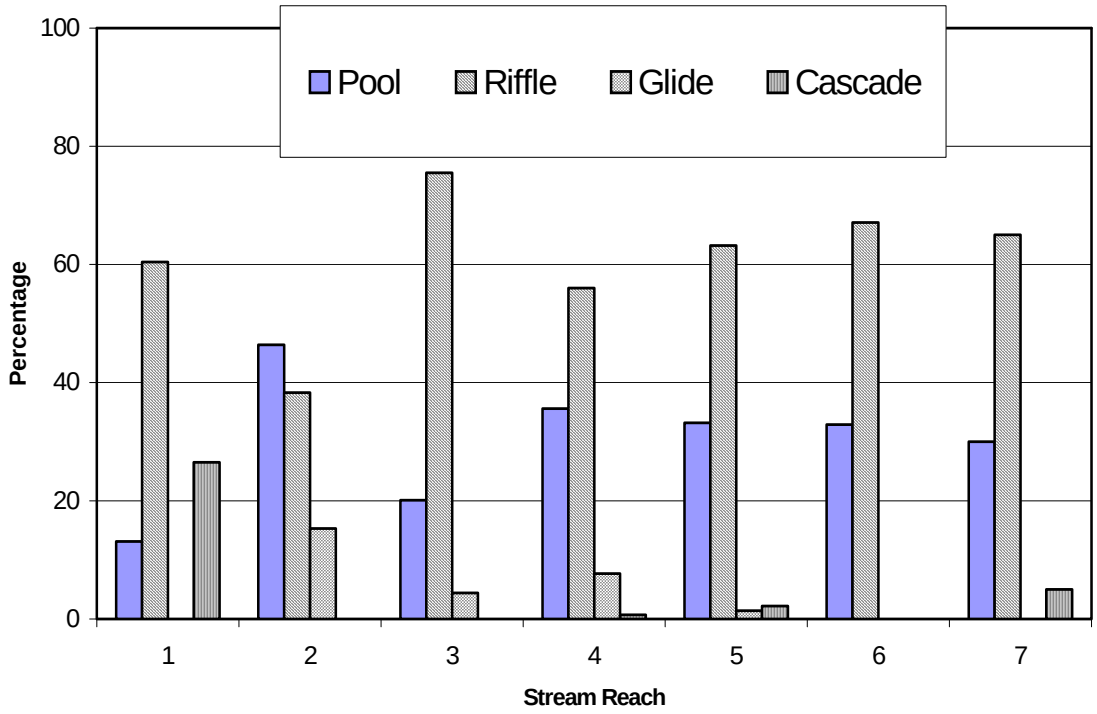

Table 13: Large Woody Debris in Stream

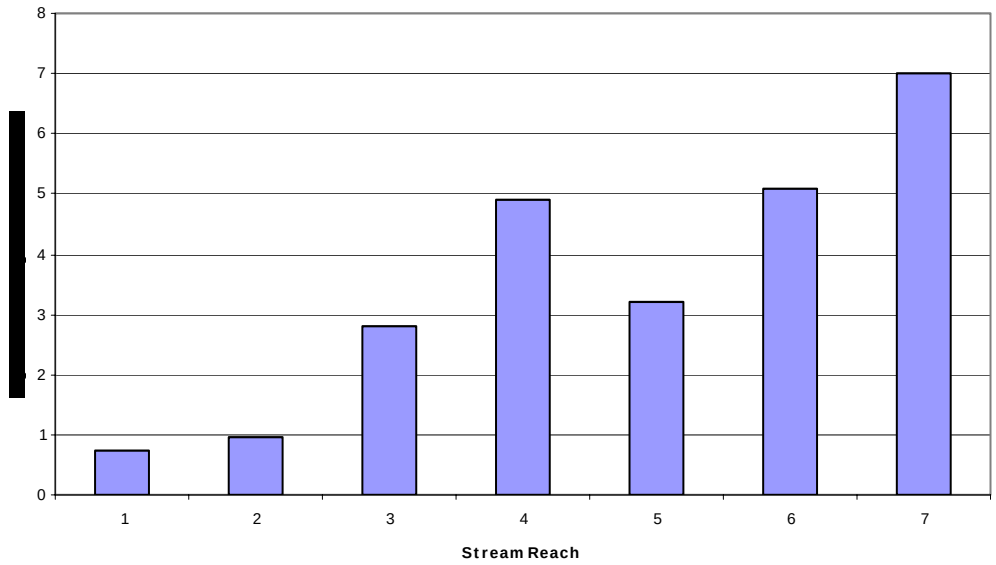

Plate 1: Bedrock gorge of Reach 1 taken from the Raptor Center.

Plate 2: Low gradient reach above the dam of Reach 2

Plate 3: Reach 3 is characterized by low gradient and a large amount of gravel.

Plate 4: Looking downstream to the east of the island in Reach 4.

Plate 5: Bank erosion at beginning of Reach 5.

Plate 6: Reach 5 is characterized by large pools and bedrock cascades.

Plate 7: Upstream end of Reach 5 looking toward channel split

Plate 8: The north fork (Reach 6) has a large amount of LWD.

Plate 9: The south fork (Reach 7) has frequent log jams.

Chapter 11: Watershed Improvements – Current Development

Introduction

In the previous chapters an inventory of the current status of the Indian River watershed was developed. The hydrological and fish habitat characteristics were studied and infrastructure development was described. Current, planned, and potential development information was collected, and permitting issues for future development were discussed. In this chapter, specific projects will be described that will help to maintain the water quality and fish habitat within the existing developed areas of the watershed.

In general, the water quality of the Indian River is very good and the overall condition of the watershed is excellent. Only a very small percentage of the watershed has seen any development, including projects such as the SJC diversion dam, subdivision and road construction, the CBS water intake facility and historical construction, logging and dredging of the river estuary. These projects have undoubtedly impacted the watershed, but the nature and extent of the direct impacts of the development, if any, are not known. Current water quality and fish habitat remains good. Water quality monitoring at both upstream and downstream locations from the developed areas shows very similar water quality results. The water requires only minimal filtering and disinfection prior to use as a potable water supply for the City and Borough of Sitka and is also acceptable for use in the Sheldon Jackson fish hatchery.

Fish habitat is well developed throughout the study area and in general supports a healthy and varied fish population. The quantity of water flowing through the primary study area is usually adequate to support fish habitat and the permitted withdrawals for use at the water intake and the fish hatchery while still maintaining the recreational, scenic and historic values of the river. Occasional periods of low flow have been noted during periods of reduced rainfall, but the shortages are of short duration.

Current development Improvements

As noted in some of the previous chapters, there is concern that deficiencies in some of the existing watershed development may adversely impact the long-term health of the river system. These potential problems include transport of potential pollutants into the river, unregulated storm water runoff surges and accumulation of sediment in the river bed. In order to address these deficiencies, several potential watershed improvement and enhancement projects are proposed, using some of the Best Management Practices (BMPs) identified in earlier chapters. In some cases, a different BMP or a combination of BMPs could be used, and not all BMPs were considered applicable. The following list of potential projects is not all inclusive. There may be other watershed concerns that have not yet been identified and that may benefit from enhancement activities. The projects listed are intended to address concerns that were identified in the Inventory portion of the Master Plan.

CBS Water Intake Improvements

The river channel is braiding upstream from the CBS water intake structure as described in Chapter 3, page 33 and as shown on Figure 6A, page 27 and Figure 6B, page 37. Some of the braiding is attributable to the water impoundment dam and some is a result of natural erosional forces. As a result, a significant portion of the water is now flowing down the left braid, bypassing the right braid where the water intake is located. If this condition continues to develop unabated, the right braid will no longer flow and the water intake structure will be unusable. The water intake dam also promotes sedimentation, resulting in downstream scour and loss of fish habitat. A river restoration project at this location will restore stream flow to the right braid, ensuring a continued supply of water for the water intake structure. The work will include excavation and river channel restoration and the reconstruction of the water intake structure. Bio-engineered features, e.g. log deflectors, vegetation, etc., may also be employed if deemed necessary and appropriate to stabilize the braiding channel and promote river flow to favor the left braid where the intake exists.

Timing on this project will be critical to avoid impact to fish habitat during spawning and migration. Permits may be required to be obtained from the Corps of Engineers, the Alaska Department of Natural Resources, Office of Habitat Management and Permitting and the Alaska Department of Environmental Conservation, among others. The total cost of this project is estimated to be as much as $300,000 to $400,000.

Sheldon Jackson Dam Maintenance

The Sheldon Jackson dam is used primarily for a water intake source for the fish hatchery, although in past years it has been used for a hydropower water source. Some of the same problems as were observed in the sediment trapping at the CBS water intake structure were also noted at this dam. Some maintenance was performed on the SJ dam last year with the removal of some of the accumulated sediment and maintenance on this dam has been performed in previous years. Periodic maintenance on this dam is recommended. The actual intervals between sediment removal are difficult to predict, since sediment accumulation is a function of stream flow and sediment load in the river and reservoir trap efficiency with the latter changing (decreasing) as the impoundment fills with deposition of stream bed materials. Sediment accumulation should be monitored and logged at least once a year. The ability of the dam to impound and divert water will be reduced over time, and sediment removal should occur periodically. Sediment removal can be accomplished mechanically with excavation equipment, or by installing an outlet

control weir that will permit the dam to be drawn down periodically, releasing the sediment load to the lower reaches of the river. Coordination of periodic sediment removal, whether mechanically removed by dredging or by out weir flushing will be required with downstream users including the Alaska Department of Fish &Game and the National Park Service.

Timing for the maintenance or construction work is also important to avoid adverse impacts on fish habitat and water quality, and permits will most likely be needed from the same agencies as required for the CBS water intake project.

The periodic cost for maintenance at the dam is estimated to be $10,000 to $30,000 per maintenance cycle. Alternatively, a one time installation of a drainage device is estimated to cost between $25,000 and $50,000 with only minor costs for on-going maintenance and permitting.

Camp Site Debris

Debris from unauthorized camps and recreational sites along the river has resulted in an accumulation of solid waste that could potentially contaminate the water supply. The sites of the camps vary seasonally and from year to year, and clean up efforts should occur at least on a biannual basis. At the present time the cleanup efforts are being performed on a voluntary basis by concerned members of the community, most often Sitka Tribe of Alaska members. A twice-yearly monitoring and cleanup program should be implemented that will identify and remove and dispose of waste before it becomes a problem. A regular monitoring and clean up program is estimated to cost approximately $1,500 per inspection, or about $3,000 per year.

Sheldon Jackson Quarry Runoff

In order to extract useable material from the SJ rock quarry, the overburden must be stripped and stockpiled. The stripping operation can result in erosion and off-site sediment transport, and long-term overburden stockpiling will also contribute to sediment production. At the present time there are sedimentation basins in use which trap most of the quarry sediment, and silt fences below the quarry trap most of the runoff from the current overburden stockpile area. These devices are working well and little if any sediment load is contributed to Indian River from the quarry operation.

Stripping and overburden removal will increase runoff velocity and quantity and concentrate runoff locations. Regular maintenance should be performed and additional sediment basins and silt fence structures and other BMPs as appropriate should be installed as the quarry operation develops and contours change.

Continued development of the quarry will require an expansion of the overburden storage area as discussed in Chapter 7, page 73. Expansion of the storage area will require a formal wetland jurisdictional determination from the Corps of Engineers and will most likely require a wetland development permit. Issues such as surface runoff and subsurface leaching will be required to be addressed before a permit will be issued. Based on the current level of information available, it does not appear that there is a significant direct surface hydraulic link between the overburden storage area and Indian River. The nature and impact of the subsurface connectivity is unknown, and additional site-specific studies will be required. Any runoff from the site can be adequately addressed with BMPs such as silt fences, sedimentation ponds and biofiltration. Future expansion of the quarry should develop and evaluate site-specific BMPs to ensure adequate control of surface runoff and other watershed impacts.

Regular monitoring and maintenance of the existing sediment trap devices is estimated to cost $3000/year. Development of an expanded overburden storage area is expected to cost between $30,000 and $50,000, and will be part of the operational costs for the quarry.

Abandoned Construction Debris Cleanup

There is significant quantity of construction debris remaining from historical sawmill and other construction operations along the banks of the Indian River as shown in Figure 10, page 75. Cleanup of this debris is justified based on safety issues. It is also possible that some degradation of the river water quality could occur as result of the continued decomposition of this material, although it is not expected to be a significant source of contamination.

Once again, for work in or along the river, the project timing and construction methods can have a significant impact of river water quality and habitat. Care should be taken to minimize disturbances outside of the areas designated for cleanup, and all operations should minimize surface disturbances. Proper storm water and runoff planning should take place well in advance of construction, and the timing of the work should be coordinated to avoid fish spawning and migration activities. Project planning should also include restoration of the wetland and riparian areas disturbed by the cleanup. As in the previously described CBS and SJ dam maintenance projects, permits may be required from the Corps of Engineers, the Alaska Department of Natural Resources, Office of Habitat Management and Permitting and the Department of Environmental Conservation. Other permits may also be required, including State Historical Preservation Office clearance if the site is deemed to have local historical significance.

The cleanup cost, including planning, investigation, design, and permitting is estimated to cost between $75,000 and $150,000.

Storm Drain Improvements

One of the effects of urban development is to reduce infiltration and concentrate and increase peak runoff. A properly designed and maintained storm drain system will promote infiltration and sediment removal and will function to decrease peak runoff velocities and volumes, promoting better habitat and water quality.

A storm drain system is currently in place in the existing residential subdivisions. Much of this storm water system exists as surface open channel flow, although there are underground culverts and drain inlets for road crossings. A series of detention basins has been constructed, and most of the runoff from the BIHA subdivisions is channeled into existing storm drain control devices. Many of the ditches are grass lined, and overall the

storm drain system is in very good condition. It appears that the normal storm runoff is not significantly impacting water quality or habitat in the primary study area.

While the existing settling basins and ditches are working well, they should be regularly monitored and maintained if necessary by removing accumulated sediment and debris and making sure the structures and ditches are intact. The drainage ditches in the subdivisions are generally in good condition; however they should also be kept clear of debris and checked regularly for erosion. Due to the steep nature of the upper subdivision areas, runoff velocities in the ditches could potentially erode some ditch sections, increasing the sediment load in the runoff. Rock check dams or plunge pools at culvert outlets should be considered if necessary to slow water and force sediment deposition. If velocities are too great, erosion of the ditch sides and bottoms could occur, and it may be necessary to consider small rip rap or rock lining. In the flatter reaches of the subdivision, the ditches should be grass lined to promote bio-filtration of sediment and to reduce the potential for erosion. Revegetation and riparian buffer zones as described in Chapter 10, page 109 are also appropriate improvements that could be considered.

The pond located between Peter Simpson Drive and Yaw Drive, designated as Kaelke Pond on Figure 6A, page 27, is part of the fish habitat in Reach 3, shown on Figure 12A, page 97. As such, it should not be used as a sedimentation basin, although it can function to buffer peak flows into Indian River during heavy runoff events as long as exit velocities don't cause erosion downstream. To prevent sedimentation in Kaelke pond, a settling basin should be installed on the upper inlet area on Yaw Drive. This location coincides with the natural drainage basin between Yaw Drive and Rudolph Walton Circle. Construction of the basin should be similar to the existing basins along Indian River Road, and should have an outlet control weir to buffer the pond from high volume and high velocity water.

The storm drain inlet near the intersection of Indian River Road and Naomi Kanosh Lane is not functioning correctly, as noted in Chapter 3, page 32. It is intended to convey water across Indian River Road, but the outlet on the east side of Indian River Road is in a small depression with no connection to a larger drainage area. This storm drain inlet and crossing can remain, but the ditch along Indian River Road should be re-graded from Benson Drive to Yaw Drive to convey and attenuate storm water runoff from the developed-areas.

The estimated costs for storm drain improvements are between $50,000 and $100,000. It is unlikely that permits will be required for this work, as the area involved is in either non-wetland areas or is small enough to be considered exempt from wetland permitting requirements. A wetlands jurisdictional confirmation should be requested from the Corps of Engineers Regulatory Division.

Unpaved Roads and Trails Improvements

Most of the road system within the primary study area is unpaved. While the current drainage ditches and storm drain system function well to trap and remove sediments, the surface of the roads can be eroded, releasing sediment into the runoff. Paving the roads with an impermeable surface will limit sediment contribution from the roads. However, paving the roads decreases permeability and increases surface flow velocities because of the smoother surface. This places more pressure on the drainage system, and if the roads are paved, the storm drain system must be well-maintained. On paved roads, and winter sanding should be done with coarser aggregate sand. Coarser-materials will more readily be trapped by storm water BMPs rather than be transported to the river. Paving also reduces airborne dust and particulates that may otherwise end up in surface runoff or cause other airborne health-related problems.

The Sitka Cross Trail is surfaced with gravel or other soil materials in the vicinity of Indian River. It is unlikely that the sediment from local trails is having any significant impact on water quality. However, it is possible to create erosion problems in steep areas due to flow along the trail. In this case, ditch protection or grass lined swales can be used to trap and filter sediment. Where the trail crosses natural drainages, culverts or depressed grade crossings can be installed to prevent runoff from damming behind the upstream side of the trail, and detention basins can be installed in steep sections to prevent ditch drainage sediment from reaching the streams.

The estimated costs for storm drain improvements are between $50,000 and $100,000. The estimated cost for asphalt paving for Indian River Road and the adjacent subdivisions is between $2M and $2.5M. It is unlikely that permits will be required for this work, as the area involved is in either non-wetland areas or is small enough to be considered exempt from wetland permitting requirements.

It was noted in Chapter 6, page 65, that new road development and upgrades to existing roads will also likely occur as the watershed develops. Of particular concern is the potential new Landclearing Landfill project, as described in Chapter 9, page 84. New roads will impact water quality and runoff volumes as surface flow is channeled and concentrated. It will be important to consider these impacts as roads are developed, and alternate routes may be needed to minimize adverse water quality and habitat problems.

Chapter 12: Future Management Guidelines

Introduction

This chapter will focus on developing strategies and guidelines to limit the impact of future proposed and potential development on water quality and fish habitat. The goals of the management guidelines are to prevent any degradation in water quality or fish habitat, and to maintain the current hydrological characteristics of the watershed, including peak runoff flows and sediment loads in the storm water.

Chapter 9 described a number of planned and potential projects that are in various stages of development and planning. The projects include:

- Residential Housing Subdivisions and Development
  - Sheldon Jackson College/Baranof Island Housing Authority residential housing.
  - City and Borough of Sitka residential housing.
  - Sitka Counseling and Prevention Services out-patient residential housing
- Commercial/Industrial Development
  - Alaska State Troopers Driver Training Facility
  - Land Clearing Landfill
- Infrastructure Improvements
  - Electrical Intertie
- Recreational Trail Improvements

These types of development will typically involve improvements that could potentially impact water quality and fish habitat in the watershed:

- Roads, streets and trails.
- New utility systems to support development, including water, sewer, electric and communications.
- Buildings, asphalt and gravel surfaced parking lots and other impervious areas.
- Site clearing and landscaping.

Each of these types of developments present challenges to maintaining water quality and habitat both during construction and for operation and maintenance after the projects are completed. Examples of problems include runoff concentrations from paved areas. As large areas are paved, rainfall can no longer infiltrate into the surface vegetation that acts as a natural buffer and filter. Runoff concentrates down gradient, increasing both water volume and velocity, and sediment loads are transported into receiving waters. Careful planning is important to minimize runoff impacts, including considering alternate access routes and locating paved areas far enough from natural drainages and streams to permit proper treatment and handling of runoff.

The following paragraphs describe some of the strategies than can be used to limit short-term and long-term impact to the watershed.

Best Management Practices

Best Management Practices (BMPs) are measures or practices that help control or prevent the introduction and transport of pollutants into the environment. BMPs are divided into two general categories, Structural and Nonstructural. Structural BMPs consist of physical structures that are constructed as part of the project and are either temporary during construction or become a permanent part of the project. Nonstructural BMPs include management guidelines, ordinances and other regulations, maintenance and operation guidelines and schedules, and water quality sampling, testing and reporting procedures among others.

BMPs during construction

The Clean Water Act established the National Pollutant Discharge Elimination System (NPDES) which mandates that construction activities on certain federally funded projects involving more than one acre, and smaller projects that are part of an overall phased development are required to prepare a storm water pollution prevention plan (SWPPP). All projects involving more than 5 acres must submit the SWPPP to the Alaska Department of Environmental Conservation (ADEC) for review. The SWPPP is intended to limit the introduction and transport of sediments and other pollutants during construction. A SWPPP includes both structural planning and management requirements and structural features that are to be put in place and maintained during construction. BMPs are the central component of the SWPPP.

The SWPPP takes into account the type of construction activity, the impacted area, topography, watershed runoff projections and other factors that influence the amount and type of pollutants that may enter the environment as a result of the construction activity. BMPs are developed as part of the SWPPP, and address the construction and environmental conditions specific to the project. A significant part of the SWPPP, the Hazardous Material Control Plan (HMCP), consists of nonstructural BMPs for the management of potential pollutants within the project limits such as oils, solvents and construction debris. The SWPPP also includes an inspection and maintenance schedule for structural BMPs, with specific actions that are required if sediment breakthrough or other pollution is observed. Structural BMPs may be temporary and others may remain as permanent features of the project.

SWPPPs and BMPs during construction are designed to safely handle runoff from storm events during the construction period before permanent structures are in place. BMPs can be used individually or in conjunction with other BMPs for complete project erosion and sediment control. The following examples include some of the most commonly used structural BMPs. A SWPPP must be tailored for a specific project type and duration, and not all of the BMPs listed below may be appropriate, and others not listed may be required. Some examples of construction-phase BMPs include:

- Interception and diversion ditches and berms – Constructed across a slope to intercept runoff and divert it to a stabilized area where it can be safely discharged at lower rates thereby promoting deposition of entrained sediment and reducing erosion and transport of new sediment.

- Slope Drains – Temporary conduits used to convey concentrated storm runoff safely down the face of a cut or fill slope without eroding the slope. Slope drains may be flexible tubing or rigid conduits. Slope drains typically require an inlet structure and outlet protection to contain runoff and to prevent scour.
- Storm water conveyance channel – A lined channel used to convey water from surface runoff to a receiving system. Channel linings may include riprap, vegetation, flexible geotextile barriers, or organic or synthetic manufactured channel linings such as porous plastic or jute mats. Channels may also include check dams to slow water velocities which prevent erosion and promote deposition of sediment loads.
- Mulching – Application of a uniform protective barrier of straw wood chips, fibers or other acceptable organic materials to prevent surface erosion in a revegetated area to provide immediate protection of the seed bed.
- Temporary sediment traps – A small temporary impoundment area with a controlled outlet used to slow water and collect sediment prior to discharge. Sediments traps may be formed by excavating below grade, berming above grade, or combination of the two.
- Vegetated buffer strip – Natural undisturbed area that is preserved along the perimeter of project that serves to filter sediment and to slow runoff velocities.
- Silt fence – Used to filter sediment loads from site runoff. Typically, they consist of vertical supports driven into the ground with a geotextile filter fabric stretched between them and keyed into the ground to prevent flow from running under the fence. The fabric filters the sediment and permit water to flow from the site. They are placed at points that sheet flow runoff will exit the project site.
- Straw bale barriers – Used to prevent erosion of soils during construction. They are placed to deflect and channel runoff and to filter sediment loads before discharge to receiving waters.
- Vehicle tracking area – A controlled entrance/exit to the project site consisting of a stabilized gravel pad or area that prevents transport of sediments and debris onto public access roads.

Both the Environmental Protection Agency (EPA) and the State of Alaska Department of Transportation and Public Facilities (DOT/PF) have developed guidelines for developing and implementing SWPPPs and BMPs. The EPA document, Storm Water Management for Construction Activities, may be found at:

http://www.epa.gov/npdes/pubs/contents_conguide.pdf.

ADOT/PF has developed the Alaska Storm Water Pollution Prevention Plan Guide, and Appendix F, Examples of Best Management Practices, of the may be found at: http://www.dot.state.ak.us/stwddes/dcsenviron/assets/pdf/swppp/english/eng_f.pdf.

Permanent BMPs

Long-term BMPs for managing and controlling runoff are necessary to minimize erosion and to prevent pollutants and sediments from reaching Indian River. Both structural and non-structural BMPs are necessary, and they must work together to provide complete and comprehensive watershed protection.

BMPs will include integrating watershed protection into the planning and design of new facilities. New impervious surfaces such as parking lots and paved streets will reduce infiltration and concentrate runoff, potentially causing downstream erosion and damage to existing runoff controls. Landscaping will change infiltrative surfaces and concentrate runoff as a byproduct of protecting houses and drives from flooding. Surface treatments, including lawn fertilizers and herbicides must be controlled to prevent biological pollutants from entering the river, and residential and industrial waste and debris such as oil, fuel and other fluids and solid wastes must be handled and disposed of appropriately to keep contaminants from entering the environment. Many of these potential watershed impacts can be handled with non-structural BMPs in the form of regulations, permits and development guidelines. However, for complete watershed protection, structural BMPs are essential.

Structural BMPs

The structural BMPs will become a permanent feature of the watershed. A comprehensive storm water collection, treatment and discharge system will include BMPs that are designed to collect and control runoff, prevent erosion, limit runoff sediment and pollutant loads and remove sediments and pollutants prior to discharge to Indian River. A storm drain system may include surface ditches and swales, controlled inlet and outlet devices, belowground piping and manholes, detention and settling basins, oil/water separators and other structures. The storm water system must also be capable of buffering runoff from storm events to prevent washout and removal of fish habitat in the river. Many of the temporary BMPs listed in the previous section can be adapted and converted to permanent features with careful advance planning.

New BMPs should also integrate effectively into the current storm water system in place in the area. Prior to designing any new BMPs, a detailed hydrographic and topographic survey should be performed and a watershed analysis performed for the specific proposed development. Natural drainages exist in the primary study area as shown on Figure 5, page 23. These drainages will need to be addressed in proposed drainage plans, and new structures will need to be integrated into the existing drainage improvements. In addition, existing drainage structures such as the detention basin/settling pond located on the east side of Indian River Road opposite Peter Simpson Road may need to be expanded to handle increased runoff. Intermediate ditches, swales, storm drain culverts and manholes may also need to be upgraded.

Examples of permanent BMP structures that may be appropriate in the Indian River watershed include:

- Swales and ditches – Permanent ditches and swales can be riprap lined or grass lined, but should be designed to limit erosion and provide sediment trapping. In steeper

areas, riprap linings will service to prevent erosion, and as slopes flatten out, grass lined swales will provide biofiltration and also promote infiltration.

- Settling/detention ponds/peak runoff buffers – These ponds and detention basins will act as sediment traps and will also provide storage capacity to buffer flows resulting from increased runoff as property develops and natural infiltration is reduced. Ponds can be excavated below existing grade or built up using berms. Weirs at the outlets of the ponds will serve to buffer peak storm events by controlling the rate of flow from the basins, evening out peak flows and preventing washouts of habitat and erosion downstream. Erosion control plunge pools may need to be established at the downstream sides of the weirs to help dissipate energy from stored water as it flows through the weirs.
- Infiltration trenches and basins – Infiltration basins and swales can be constructed to permit collected runoff to be reabsorbed into the subsurface soils. Use of these types of devices may be limited in the Indian River area, as near-surface rock and impermeable barriers may limit the ability of the soils to absorb water. Site specific subsurface explorations may be necessary before selecting this type of BMP.
- Revegetation/Biofiltration - -One of the most effective BMPs is revegetation of disturbed areas and planting grasses and shrubs as part of a development plan. Natural buffer zones can be established that have multiple uses such as recreational activities and are relatively easy to maintain. These areas can serve both to buffer sheet flow runoff and to provide filtration and sediment trapping. Wetland ecology principals can also help to select plants and grasses that area capable of treating and removing pollutants from the water in natural or constructed wetland applications.
- Riparian BMPs - BMPs are also available for riparian zones along the river as outlined in Chapter 10. The U.S. Forest Service Soil and Water Conservation Handbook, FSH2509.22 (accessible through the Forest Service website at http://www.fs.fed.us/r10/ro/policy-reports/bmp/index.shtml) lists a number of BMPs that should be considered for development activities in the riparian zone along the river. A more complete discussion of these BMPs as they apply to Indian River is located in Chapter 10, page 109, Recommendations for Habitat Protection. BMPs include erosion control measures along bridges such as detention basins to limit the amount of sediment entering the river from runoff flowing parallel to the trails, and sizing culverts to enable fish passage beneath roads and trails. Side slopes of roads and trails should also be designed to provide erosion control with seeding and vegetation. Establishing a riparian buffer zone along the river will also limit habitat degradation due to development and prevent sediment from reaching the water.

ADOT/PF has developed the Alaska Highway Drainage Manual as a guideline for designing and constructing drainage improvements on state-funded highways and roads. Most of these structures are applicable to the types of improvements under consideration for the Indian River watershed. Chapter 16, Erosion and Sediment Control, provides design information on drainage improvements for sediment and erosion control, and Appendix A illustrates BMPs for erosion control. The ADOT/PF information may be found at http://www.dot.state.ak.us/stwddes/dcspubs/manuals.shtml#, and includes links

to Chapter 16 and Appendix A of the Highway Drainage Manual. The BMPs listed in Appendix A are typical of the types of improvements that would be appropriate for development within the Indian River Watershed.

Non-structural BMPs

Non-structural BMPs have two primary purposes:

- To reduce or eliminate pollutants that impact water quality at their source, thus reducing the need for structural control requirements, such as the elimination or reduction of the introduction of oils, greases, fertilizers or pesticides into the storm water.
- To address water quality concerns that are not cost effectively handled by structural controls. It is not economically feasible to install structural BMPs for every possible contingency that may occur in a watershed. An effective monitoring and control system for determining illegal or uncontrolled discharges into the storm water collection system is desirable.

Non-structural BMPs are also intended to ensure that structural BMPs are established as needed and continue to perform as required to maintain watershed water quality and habitat. Non-structural BMPs include regulatory policies and guidelines, structural BMP maintenance activities and water quality monitoring to verify that the BMPs are performing as intended and that watershed water quality goals are being met.

Non-structural BMPs are similar to SWPPP requirements that are developed and implemented for construction projects, and include both pre-development and post-development BMPs. Pre-development BMPs are used to establish the type of post-development structural and non-structural BMPs that will be required for a specific development project. Examples of pre-development non-structural BMPs include planning and land use documents and regulatory permitting requirements.

Post-development non-structural BMPs include watershed stewardship education, urban housekeeping recommendations and requirements, street maintenance, snow removal and de-icing procedures, and water quality monitoring, testing and reporting. Examples of these types of non-structural BMPs include public works maintenance policies, procedures and schedules, homeowner and landowner hazardous and solid waste disposal requirements, permit stipulations, municipal codes and ordinances and other regulatory restrictions or requirements.

The American Society of Civil Engineers (ASCE) has developed a database of BMP performance data in a standardized format for roughly 200 BMP studies conducted over the past fifteen years. The Urban Water Resources Research Council (UWRRC) of ASCE developed the *International Stormwater Best Management Practices Database* under a cooperative agreement with the U.S. Environmental Protection Agency. It is available for review at http://www.bmpdatabase.org/index.htm. Additional resources for BMPs, both structural and non-structural, may be found through the Colorado Urban Drainage and Flood Control District website at http://www.udfcd.org.

Current Watershed Development Management Tools

Regulatory management tools are an essential part of maintaining water quality as the Indian River watershed develops. A number of different agencies and organizations are responsible for issuing the permits that may be required for development to occur within the watershed. Chapter 8, page 77, discusses some of the existing permits and relevant planning documents that are intended to guide development in the Indian River watershed. The following paragraphs summarize the management tools that each organization has available to them.

City and Borough of Sitka

The CBS Planning Commission establishes planning and zoning policies that are implemented and monitored by the CBS Planning Department. Zoning ordinances limit the types of development that can occur in the various land categories. Title 22 of the CBS Zoning Code includes regulations and requirements for development. A table summarizing the various types of zoning and the permitted uses for the property within the Indian River watershed is located in Chapter 8, Table 5, page 81. The CBS zoning ordinances also allow for Conditional Use Permits (CUP) that permit certain activities and developments that are otherwise restricted within a zoning area to occur. CUPs require a hearing and formal approval from the Planning Commission.

Sitka has also adopted a Comprehensive Plan that outlines the goals and objectives for development in Sitka and is the official policy for actions by the Sitka Assembly and the various staff, boards and commissions. The Planning Department is responsible for reviewing applications for new subdivisions and uses the Comprehensive Plan to determine if the proposed development is consistent with the plan and within current zoning ordinances. Chapter 8, page 77 describes the Sitka Comprehensive Plan. The zoning ordinances also restrict development within the 100-year flood plain. The 100 year-flood is defined as a flood event that has a 1% probability of being equaled or exceeded in any single year. The flood plain boundaries are determined based on historical flood and high water data. The flood plain boundaries for the Indian River watershed are shown on Figure 5, page 23.

The CBS Public Works department is responsible for reviewing and approving subdivision plans and issuing building permits. Subdivision developers are required to submit a drainage plan as part of a project development plan, and the City Engineer must approve the plan before a subdivision development is approved for construction. The Public Works department is also responsible for snow and ice removal, street sanding and storm drain system maintenance within the public right-of-way.

State of Alaska

A number of different State of Alaska agencies have regulatory oversight regarding development within the watershed. They include the Department of Environmental Conservation (ADEC), the Department of Natural Resources (DNR), the Department of Fish and Game (ADF&G), and the State Historical Preservation Office (SHPO). Other state agencies may also be involved with development for specific projects, such as the Department of Transportation and Public Facilities (DOT/PF) for roads and state building projects.

The Coastal Zone Management Plan, as described in Chapter 8, page 79, is a cooperative plan between DNR and the City and Borough of Sitka. The Plan contains guidelines and goals for development that have been established specifically for the City and Borough of Sitka. Development projects within the coastal zone are required to fill out and submit a questionnaire to DNR, which is responsible for determining the consistency of the development with the State Coastal Program. Other state and federal agencies will be asked for input in the process.

For the development of state-funded road and building projects, ADOT/PF will require the submittal and approval of a Storm Water Pollution Prevention Plan that will contain requirements for short-term storm water management BMPs. Permanent storm drainage management plans must also be consistent with the Alaska Highway Drainage Manual. ADEC will also review plans for consistency with surface runoff management and water quality regulations.

Projects that directly impact the river bed and riparian zone such as water intake improvements, dam maintenance and reconstruction, and trail and bridge crossings will require permits from DNR. Water quality and fish habitat issues will be identified and appropriate measures will be required to ensure that state regulations for development within river systems are followed.

Federal Agencies

The U.S. Army Corps of Engineers is responsible for issuing development permits on the waters of the U.S and related wetlands. Chapter 5, page 57, provides an in depth discussion of the wetland permitting requirements and processes. It is likely that wetland permits will be required for most development within the watershed, and a wetland jurisdictional determination should be made for any proposed development on Indian River or it's tributaries. Other state and federal agencies are often involved in the development of specific permit stipulations that become part of a wetland permit. Many projects can be permitted under a variety of nationwide general permits that have been issued for certain categories of projects. Other projects may require an individual specific wetland permit. The wetland permitting process usually involves public hearings prior to final issuance of the permit.

Proposed Management Improvements

The Indian River watershed is very well managed at the present time. Water quality remains high, and abundant fish habitat supports a variety of fish species. The amount of developable land remaining within the watershed is relatively small, and the existing review and permitting processes can be used to ensure that water quality and fish habitat goals are met. The existing management tools described in the preceding paragraphs should be adequate to ensure responsible development of new projects within the watershed. However, as development pressures increases, a few additional storm water management tools may help guide development to maintain the current water quality and fish habitat status.

Some specific recommendations for new management tools are:

1. A general Storm Water Management Plan (SWMP) for Indian River should be developed. The SWMP should describe the specific water quality and runoff volume goals, requiring that BMPs be in place that result in no net change in the water quality reaching Indian River, and no net change in the volume of water that reaches the river during storm or runoff events. It is suggested that the SWMP become part of the current Title 22 of the CBS Subdivision Zoning Code.
2. Project-specific SWMPs should be required to be submitted with all proposed subdivision improvement projects. The SWMP should include an analysis of the current hydrology in the project area and describe the measures that will be undertaken to ensure that the runoff quality and storm event runoff volume goals are met. Permits for development should not be issued unless the City Engineer has reviewed and approved the SWMP.
3. Develop a program of regular maintenance of existing storm water structures such as ditches, culverts, manholes and detention ponds, and establish a budget for funding the maintenance.
4. CBS should seek grants to develop a water quality monitoring program that provides for water quality sampling during storm events to verify that water quality and runoff volume goals are met. Program development should include institutionalizing a monitoring and sampling program. The water quality and quantity information obtained can be used to develop a list of recommended BMPs for the Indian River watershed that have a verifiable success rate in meeting storm water management goals. This program could develop into an essential part of the review process for SWMPs that are submitted for approval, comparing current BMP performance with the BMPs proposed for the new development.
5. Review and modify the above items 1, 2 and 3 as appropriate as data from item 4 gives insight to the efficacy of BMPs implemented in the Indian River Watershed.

Appendix A - Indian River Working Group Contact List

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Appendix B – Indian River Master Plan Source Documents

Appendix B - IRMP source document index - final

Doc. #	Doc. Type	Date	Subject/ Description	Obtained From	Agency
1	CD		city-key.dwy & city-key ownership.pdf	Planning Dept. Wells Williams	City and Borough of Sitka
2	CD		Indian River JPEG		City and Borough of Sitka
3	CD		NPS Topo- Sitka		National Parks Service
4	CD		Indian River PPT solidwaste		Sitka Tribe of Alaska
5	CD		Indian River		US Forest Service
6	CD		Indian River Aerials, watershed, Kaelke Pond Power Plant w/excel fish table	Phil Mooney	Alaska Dept. of Fish and Game
7	CD		Ashaak SD as-builts		
8	CD		Kaasda- Heen Shaak as-builts		
9	CD		sit.all.dwg		
10	CD	1-Jan	Preliminary.dwg		City of Sitka
11	Floppy Disk		Sitka- Landclearing Power Plant	Hugh Bevan	City of Sitka
12	Letter	12/6/2002	Letter of interest in creating Watershed Council in Sitka		
13	Memorandum	7/3/1984	Indian River		Commercial Fisheries
14	Survey	Nov-95	Aquatic Resource Survey: Indian River		U.S. Dept. of Agriculture
15	Study	Dec-87	Instream Flow Requirements		National Parks Service
16	Memorandum	12/3/1987	Indian River Adjudication		Habitat
17	Study	Oct.-2001	Origin of Chinook Salmon in Indian River		Sitka National Historical Park
18	Study	5/5/1980	Indian River Coho Population Study		
19	Assessment	Oct.-2002	Environmental assessment for addition to Sitka National Park		National Parks Service
20	Report	Sept.-2001	Fish recourse Report- Indian River		Sitka National Historical Park
21	Report	2003	Water Quality of Indian River		National Parks Service
22	Report	6/10/2002	2001 Watershed Control Report	website	City of Sitka
23	Report	Sept.-2002	Non-Motorized Transportation Plan	Lynne McGowan	City of Sitka
24	Booklet	Nov-98	General Management Plan		Sitka National Historical Park
25	Map	1998	Sitka: Official map and Guide		Sitka National Historical Park
26	leaflet	Oct.-2002	Taking Care of Streams		OSU, UI, WSU, UA
27	Summary	4/14/1984	Basin Wide Adjudication		Dept. of Natural Resources
28	Bulletin	Feb-66	Sitka Mining District		Juneau- Douglas Community College
29	Statement	5/15/2001	Indian River Water Rights	Greg Dudgeon	Sitka National Historical Park
30	Study	Jun-89	State Land Selections		Alaska Department of Natural Resources
31	Report	Oct.-2002	Northern Southeast Area Plan		Alaska Department of Natural Resources
32	Code Booklet	Sept.-03	Title 21 Subdivision Code	Wells Williams	City of Sitka
33	Map		Status Plat Maps	Marlene Campbell	City of Sitka
34	Drawings	4/24/1992	Project Development Drawings		Alaska State Troopers
35	Permit	5/12/2000	Core of Engineers permit	Greg Dudgeon	Sitka National Historical Park
36	Report	Aug-87	Instream Flow Investigation Indian River by USFWs	Greg Dudgeon	Sitka National Historical Park
37	Letters and Permits	2001-2002	Storm Water Pollution Prevention Plan Sheldon Jackson Indian River Quarry	Dan Jones	D.G. Jones Association
38	Letters, Reports, Permits	2001-2002	Sheldon Jackson Quarry COE Permit Modifications to Silver Bay 21 401 Permit	Dan Jones	D.G. Jones Association
39	Resolution & Meeting Minutes	1/22/2004	Cultural and Historical Values of Indian River	Jessica Perkins	Sitka Tribe of Alaska

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